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ECONOMIC GEOGRAPHY

APRIL

AGRICULTURAL REGIONS OF ASIA
George B. Cressey

THE BAY OIL INDUSTRY OF ST. JOHN
Earl Shaw

LOCATION FACTOR IN THE CHOICE OF FREE PORT SITES
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FURNITURE INDUSTRY OF THE SOUTHERN APPALACHIAN PIEDMONT
Ben F. Lemert

LAND ECONOMY OF WARREN COUNTY, KENTUCKY
J. Sullivan Gibson

CLARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

OUR CONTRIBUTORS

Dr. Cressey, head of the department of geography and geology, Syracuse University, received his Ph.D. in geology from University of Chicago, 1923, and his Ph.D. in geography from Clark University, 1931. During his six-years' sojourn in China, where he served as professor of geography at the University of Shanghai, he traveled throughout much of the country studying various regions and collecting material for his book, "China's Geographic Foundations," recently published.

Dr. Shaw, professor of geography at the State Normal School, Worcester, received his B.B.A. and M.S. from Washington University, St. Louis, and completed the requirements for his Ph.D. in geography at Clark University, which degree was conferred in June, 1933. This article, together with several others, was written as a result of two months' field work in the United States Virgin Islands in the fall of 1931. During the second semester of the school year 1931–1932, Mr. Shaw served as visiting professor in geography at the University of Puerto Rico.

Mr. Anderson, formerly assistant professor of economics at the University of Vermont, is studying at Columbia University at the present time where he is a candidate for the Ph.D. degree. He received his A.B. degree from Upsala College and his A.M. degree from Clark University in 1927 and 1928 respectively. He has previously contributed to ECONOMIC GEOGRAPHY and is also the author of "Forests and Forest Activities in Sweden," in the February, 1933, Journal of Geography.

Dr. Freeman, head of the geography division in the State Normal School at Cheney, Washington, studied geology at the University of Michigan and at Northwestern University, and received his Ph.D. in geography from Clark University. He is the author of a *Geography of Washington* and has contributed articles to many scientific magazines, two of which, "Economic Geography of the Hawaiian Islands" and "Land Utilization in the Scablands of Eastern Washington," appeared in the July, 1929, and the January, 1931, issues of ECONOMIC GEOGRAPHY, respectively.

Mr. Dickinson, A.M., is at present lecturer in geography at the University of London where he has concentrated especially on his chief interest of study—mainly urban geography. He spent the greater portion of a year in the United States studying problems of urban geography. He collaborated in the recent publication of a book "The Making of Geography." "Markets and Market Areas of East Anglia" is a portion of his study in East Anglia, made in the preparation of his dissertation for the doctorate.

Dr. Lemert, instructor in economics and economic geography at Duke University, received his B.S. and M.A. degrees in foreign trade at Ohio State University and his Ph.D. in geography from Columbia in 1933. His thesis, "The Cotton Textile Industry of the Southern Appalachian Piedmont," appeared in September of the same year. He is a well-equipped economic geographer, having combined first-hand information with extensive travel and intensive study.

Mr. Gibson received his undergraduate training at Abilene Christian College, Texas, and was instructor in geography at that college from 1926 to 1928. Graduate study at the University of Wisconsin rewarded him with a Ph.M. degree from that institution in 1929. Pursuing further graduate training and research at Clark University, he has now fulfilled, with the completion of his thesis, all the requirements for the Ph.D. degree. The graduate study combined with extensive field work in the Pennyroyal district of Kentucky, has admirably equipped Mr. Gibson for this exhaustive treatment of Warren County.

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CHINA

A PROBLEM; a power for peace or war; a competitor in industry and trade; a potential colony; a possible field for Japanese imperialism and expansion; an open market for European and American goods; a vast reservoir of man power; an empire; a "yellow" peril; a threat; a mystery; and many more definitions have been given to the land and people we call China. Vague and uncertain, indefinite and inchoate, that vast but well-defined country and its more than four hundred million people have thrown their shadow over the shores of the Pacific from time immemorial. They have been more a word and an idea than a reality, to most of us.

What part China has played in the history of the Orient we may never fully know or realize; what part she is still to play in the history of the world is just as hard to foresee. No longer may her influence be kept within the borders of her seas and her high mountain walls. As pawn or major piece she may checkmate the most powerful pieces arrayed against her on the chessboard of the world's political and economic game. What potentialities she possesses we can not now know, nor guess, for no one may predict her strength or weakness.

The character of her people is all too little understood, the extent of her resources too little known, the advantages of her terrane too little measured, to warrant as yet a gauge upon her future possibilities. The affairs of the Pacific peoples are, as yet, too unshaped to afford a clue to their ultimate relation to China. The relative importance of the Pacific itself in the activities of the world is as yet too indistinct to permit any appraisal of the part it is destined to take.

China, and China's millions, constitute the dominant, if unknown, element in the Pacific equation, an element as yet not resolved into its factors—the direction and extent of its forces. China is the X of the world's political and economic problem.

ECONOMIC GEOGRAPHY

VOL. 10 APRIL, 1934 No. 2

AGRICULTURAL REGIONS OF ASIA

PART VI

CHINA

George B. Cressey

JUST how large and usable is China, and how many people does it contain? Upon these fundamental questions depends the answer to agricultural productivity and over-population. Behind all the manifold problems of political coherence, social readjustments, and economic emergence lie the basic factors of land and people.

Most maps of Asia label a large yellow-colored section in the southeastern quarter of the continent as China. Even this vast area is not all that once was the Middle Kingdom, for the court at Peking at one time received tribute from Siberia, Korea, Formosa, Indo-China, and the south slopes of the Himalayas.

The suzerain limits of present-day Greater China include the 28 provinces, together with the two territories of Outer Mongolia and Farther Tibet. Over these latter areas no actual jurisdiction has been exercised since the Revolution of 1911, and no agricultural data are available. For statistical purposes it is, therefore, better to refer to Provincial China. Since 1932 Chinese authority has also been excluded from the three Manchurian provinces and Jehol.

The oft-used expression *China proper* is without precise meaning, but commonly refers to the original 18 provinces south of the Great Wall and east of the Tibetan plateau. Within Provincial China are large areas of land the usability of which is limited on account of topography, soils, or climate, so that the term Agricultural China may appropriately be used for the eastern areas where the bulk of the people actually live. The population of Greater China, Provincial China, and Agricultural China is much the same, but the density varies markedly with the area considered.

Greater China is credited by the Encyclopedia Britannica with an area of 4,277,260 square miles. Measurements by the writer give Provincial China 3,097,597 square miles, while Agricultural China covers but 1,462,682 square miles.

Since 1911 all population estimates, both official and private, have exceeded 440 million people, with the most detailed figures, those of the Post Office for 1926, amounting to 485,508,838. After carefully considering all available evidence, including losses from famine and civil warfare, Condliffe considers it not improbable that China's population is increasing at the rate of 37 million per decade.

On the basis of the last Post Office figures, Greater China has a population density of but 120 per square mile, while for Provincial China the figure rises to 156 per square mile. Agricultural China, however, shows a crowding of

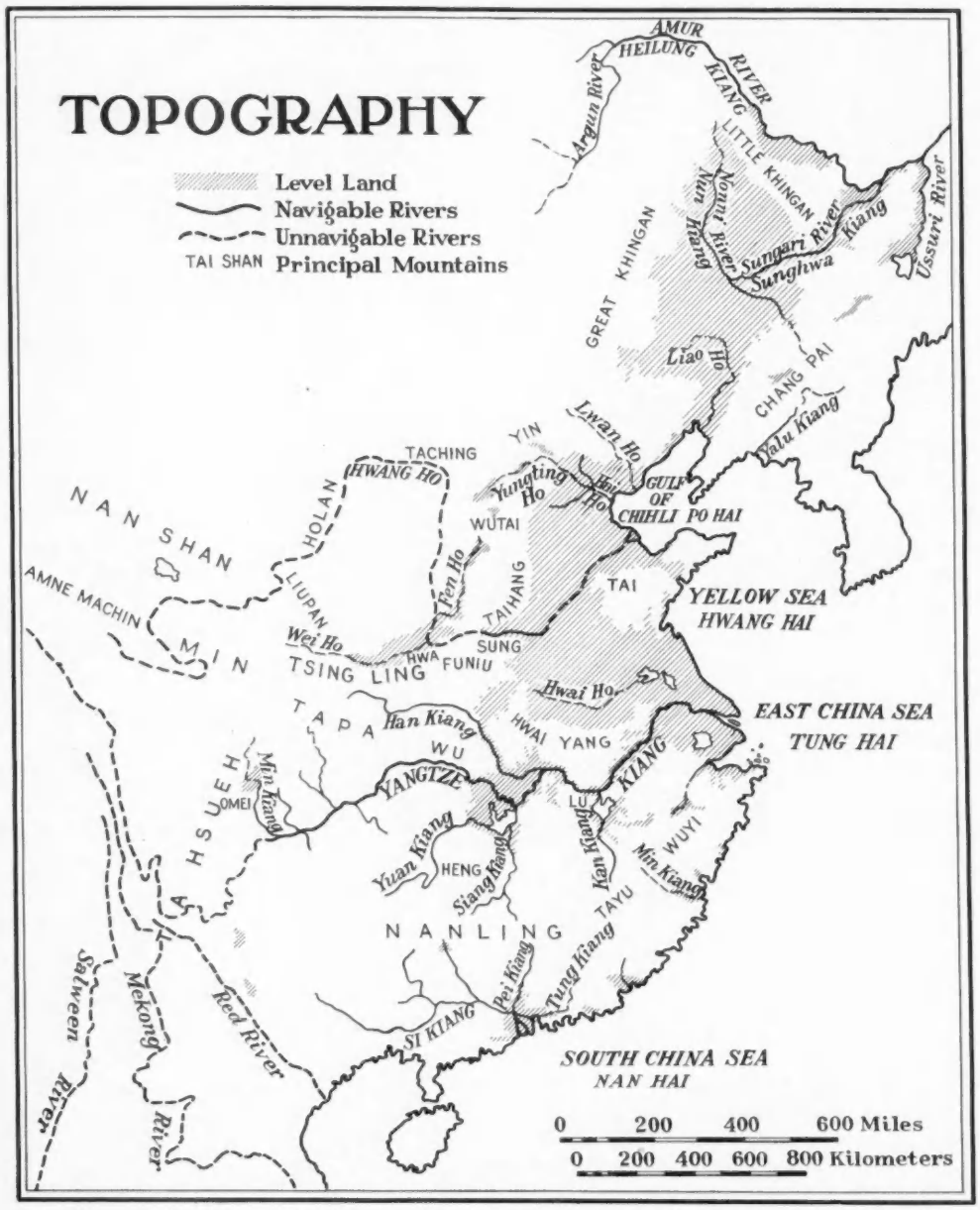

FIGURE 1.—The most striking feature of the land forms of China is the limited area of level land. Extensive plains are found only in central Manchuria and in the compound deltas of the Hwang, Hwai, and Yangtze. In addition to the mountain ranges named, there are large areas of rugged relief, often without definite trend. (From *China's Geographic Foundations.*)

326 per square mile, and in such regions as the North China Plain the density increases to 647 per square mile. Still smaller areas have fully three times this average. Perhaps the truest picture of agricultural land resources is shown in the figures of population per square mile of cultivated land. For all of Agricultural China there are no less than 1,479 people to each square mile of farm land, or an average of 0.43 acres per person. Since China is predominantly agricul-

tural, with three-fourths of the people obtaining their livelihood directly from the soil, this rural congestion is one of China's most pressing problems.

LITERATURE

Certain material in this article, including the tables and dot maps, except that for cotton, is taken from the author's book entitled "China's Geographic Foundations, A Survey of the Land and Its People," published in 1934 by The McGraw-Hill Book Company. It is fully covered by their copyright and is used here by permission. Detailed bibliographic references and additional data may be found in the above-mentioned volume.

"The Soils of China" by Charles F. Shaw, and "A Reconnaissance Soil Survey of a Portion of Kwangtung Province" by Robert L. Pendleton, both discussions being published by the National Geological Survey as Soil Bulletins No. 1 and No. 6 respectively, served as a basis for the discussion of soils of China, and the data available in these bulletins were considered in the interpretation of the agricultural regions and land utilization.

Additional data on the climates of China are discussed by Chu Co-ching in his "The Climatic Provinces of China," Memoir I of the National Research Institute of Meteorology, published at Nanking in 1930, and by B. Burgoyne Chapman in his "The Climatic Regions of China," published as Bulletin No. 3 of the College of Agriculture and Forestry at the University of Nanking in 1933. Further references are mentioned in the course of the discussion to follow.

THE TOPOGRAPHIC SETTING

China is geographically diverse. Low alluvial plains, barren mountains, deserts, jungles, and glacier-clad peaks make up its vast extent. Unfavorable land forms cover a much larger proportion of the area than in the United States or Europe. Just how little of China is usable is shown in the figures for cultivated land. Despite centuries of pressure from famine and invasion, extensive empirical adjustments, and a super-abundance of man power, the entire cultivated area amounts to but 328,125 square miles, equal to 22 per cent of Agricultural China or 11 per cent of Provincial China. To assume, as some have done, that China has available resources of arable land comparable to those of the United States is to fall into serious error.

The mountain structure of China begins in Tibet. From that lofty plateau long ranges project eastward across China, one of which, the Tien Shan, curves eastward from northwestern Tibet and encloses the Tarim Basin of Sinkiang. Across northern Tibet and continuing eastward toward the Pacific are the ranges of the Nan Shan and the Kun Lun, separated by the Tsaidam Swamp and the azure lake of Koko Nor. Within the provincial limits of China, the Kun Lun system reaches its climax in the Tsingling Shan, which divides China into two major geographic regions, the North and the South, characterized by striking contrasts in climate, agriculture, and human activities. These mountains extend eastward under various names between Yangtze Kiang and Hwang Ho to the latitude of Nanking, where they disappear beneath the delta plains. Farther north, the topographic continuation of the Nan Shan may be found in the Alashan or Holan Shan, Taching Shan, and the Khingan ranges.

In west central China lies the mountain-girt Red Basin of Szechwan, to the south of which poorly defined mountains continue across South China to the

Pacific. North of Canton these are known as the Nanling or Nan Shan, not to be confused with the Nan Shan of Tibet. All of China south of the Yangtze is a complex land of hills and low mountains with elevations commonly less than half a mile, sometimes known as the South China Highlands.

Level land is present in the Yangtze Plain, the North China Plain, and the Manchurian Plain. Aside from these regions, alluvial areas are limited to deltas and flood plains. There are several million square miles in China where on clear days one is rarely out of sight of hills or mountains. These topographic features break up China into dissimilar fragments. Were it not for her comparative isolation in southeastern Asia, there might be but little common culture and even less political cohesion.

The two great rivers of China, Hwang Ho and Yangtze Kiang, pass through very different environments along their courses from Tibet to the sea. Not only are there marked climatic differences between their two basins, but geomorphic developments have produced striking differences between various parts of their courses, so that there is little more than hydrographic unity to their respective valleys. Attempts to treat these river systems as geographic units necessarily violate agricultural and human adjustments. Other important river systems are Heilung Kiang or Amur with its tributary, Sunghwa Kiang or Sungari in the far north, Liao Ho in southern Manchuria, Hwai Ho midway between Hwang and Yangtze Rivers, and Si Kiang or West River in the south. The various rivers, together with a network of canals in the humid lowlands, provide 100,000 miles of waterways for native craft. Only Yangtze is navigable for ocean vessels, which regularly reach Hankow, 600 miles inland.

CLIMATE AND THE GROWING SEASON

Three factors govern the climatic régime of China: its monsoonal position in southeastern Asia, the tropical typhoons that sweep in from the Pacific, and the succession of cyclonic storms that move eastward from the interior. These combine to give marked contrasts from place to place, as well as variability from time to time.

While the basic factor in China's climate is the seasonal to-and-fro drift of the atmosphere known as the monsoon, this feature is much less pronounced than in India. It represents a general tendency evident in statistical averages rather than a steady wind. During the summer months the winds blow in from the Pacific with a general southerly or southeasterly direction, while the winter monsoon varies from northwest in North China to north in East China and northeast in the South. Unlike the situation in India, the winter monsoon is stronger and more steady than that of the summer.

Rainfall varies with the monsoon. The seasonal contrast is more pronounced in the North than in the South, where all months receive at least an inch of rainfall. Fortunately, the rain everywhere falls during the warm season and is well timed for the needs of the crops. In the southern provinces the total is adequate and famine from drought is rare. The amount rapidly diminishes northward and the time is less dependable, so that cultivation is hazardous. This is especially the case in the Mongolian borderlands where there is always a deficiency for normal agriculture.

The typhoons that bombard the southeastern coast are among the most destructive storms known anywhere. These tropical disturbances involve winds in excess of 100 miles an hour, and are heavily charged with rain. Where this water is hurled horizontally,

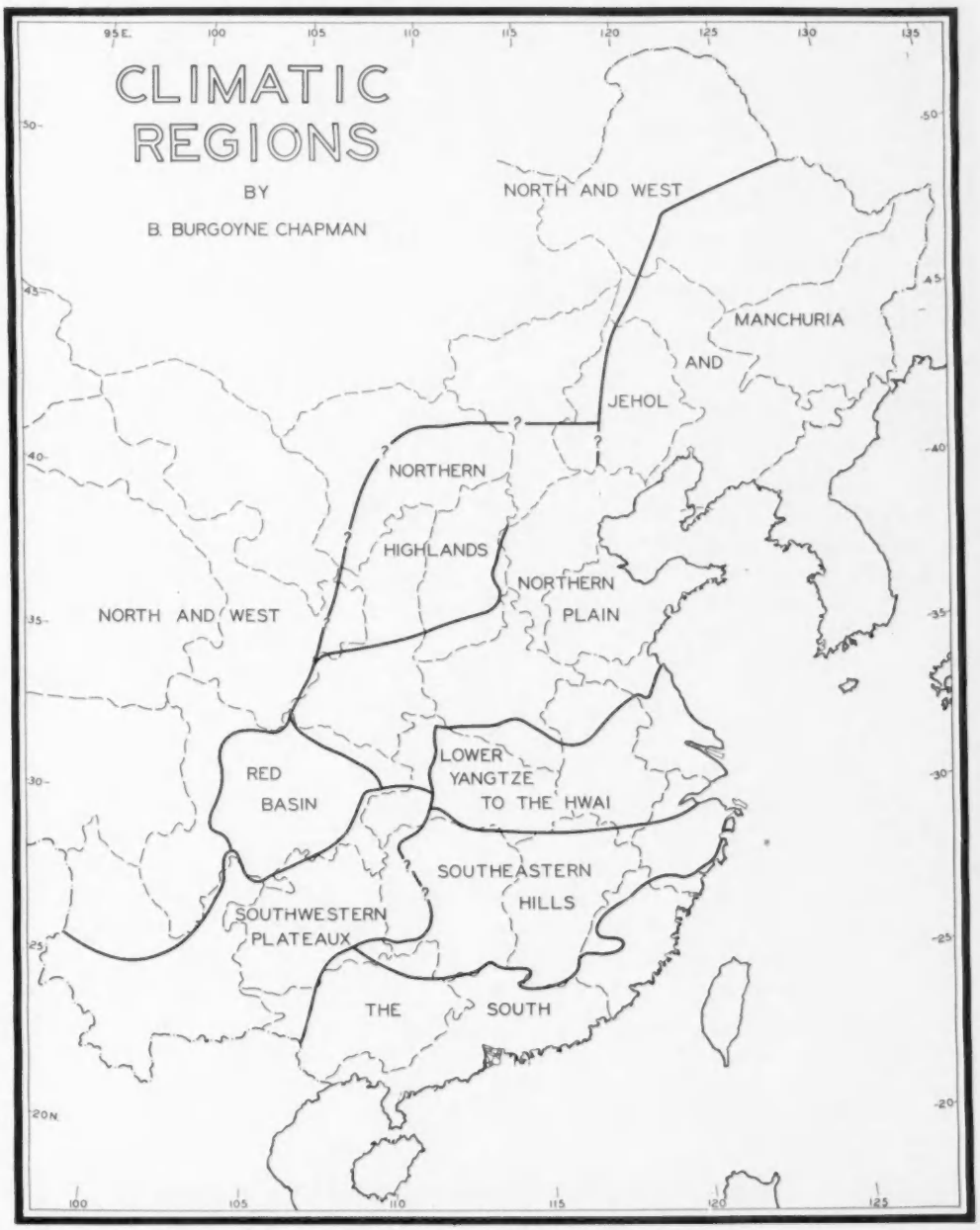

FIGURE 2.—The most striking climatic characteristic of China is the contrast between the green sub-tropical South and the brown semi-arid North, with a boundary midway between the Yangtze and the Hwang. Chapman's divisions are the most recent regional proposal.

it may result in serious damage to shipping or coastal settlements. The most intense phase of the typhoon occurs over the sea; upon entering the continent the destructive characteristics are lost, although some rain may be imported several hundred miles. Most typhoons occur during the summer and early fall.

Only within recent years has the importance of continental cyclones and anticyclones been appreciated in China. The majority of the weather stations

have been near the coast, whereas the cyclonic storms appear in the interior and move eastward. The origin of these storms is obscure. Some unquestionably come across Siberia from the North Atlantic storm track, others may be traceable to the weak depressions of the Ganges valley, which in turn may have come from the Mediterranean. Many of the storms first appear in the middle Yangtze valley. Whatever their origin, these lows and highs bring to central China a succession of weather changes of the type familiar to the United States, but of much weaker development. According to the quadrants involved, they supplement or retard the monsoon tendency. Polar front conditions and the wedge action of southward moving cold air masses appear to be significant factors in rainfall.

South China has an annual rainfall of over 1,000 millimeters, reaching a maximum of 1,800 mm., while in the North the range is from 800 mm. down to 400 mm. Parts of North China have a rainfall variability as high as 40 per cent. Not only is the precipitation marginal here, but eccentricity in both time and amount render agriculture particularly precarious. This is especially serious in an overcrowded area, with the result that famine, whether from drought or flood, is all too common.

Summer temperatures are much the same from north to south, but the northern winters are severe and there is a sharp temperature gradient. Thus, where one or possibly two crops may be raised in the North, the South produces two or three.

Information as to the length of the growing season has been difficult to secure, but has recently been collected by Chapman who, in his "Climatic Regions of China," divides China into nine regions. His generalizations indicate that the available growing period is twice as long in the South as in the far North.

The South	365 days
Southeastern Hills	304 days
Southwestern Plateaus	Inadequate data
The Red Basin	329 days
The Lower Yangtze	295 days
The Northern Plain	240 days
The Northern Highlands	189 days
Manchuria (part) and Jehol	200 days
North and West Manchuria	180 days

SOILS

The soils of China are as diverse as her land forms and climate. For the most part they have been robbed of their humus content and have poorly developed profiles. Alluvial plains spread out by the various rivers provide the best agricultural lands. Terracing is conspicuous in the Loess Highlands, Red Basin, and on the lower slopes of valleys south of the Yangtze. On many hillsides erosion has stripped off the finer weathered products leaving only sterile gravels incapable of utilization.

Modern soil studies have recently been made by Shaw and Pendleton, and the National Geological Survey is issuing a valuable series of bulletins. Preliminary field work shows a marked contrast between the leached non-calcareous soils south of Hwai Ho and the generally calcareous soils to the north. This rather abrupt transition corresponds with the shift from rice culture to kaoliang and millet. The best soils are in the northern provinces where limited and uncertain rainfall handicaps their utilization.

A VEGETABLE CIVILIZATION

China is a nation of farmers, and only as they prosper can the nation as a whole advance. Agriculture forms the foundations of the social and economic structure, and involves several times as many people, far more capital, and is much more fundamental to the national welfare than all other occupations put together. Approximately three-fourths

of the people obtain their livelihood directly from the soil, and it is these folk who make up the real China. In few other large countries do people live so close to Mother Earth, and the density of the rural population closely parallels the productivity of the land, in some places reaching figures in excess of 2,000 per square mile.

Chinese agriculture has had a long and honored history, so that at least thirty centuries of farmers have been able to till the same fields. The culture has been built so largely upon an agricultural foundation that China has been well described by Goodnow as having a "vegetable civilization." Out of the soil, rather than from mines or forests or herds, have come the materials of Chinese life.

The patience and industry of the Chinese farmer has become proverbial. Centuries of experience have shown the best crops for different areas, and while scientific experimentation has not been available the tillers of the soil have been guided by a keen practical common sense. Agricultural practices have been developed that tend to maintain the fertility of the soil and thus conserve, rather than exploit, its productivity.

The diet is based almost entirely on sown crops, so that grains furnish over 90 per cent of the energy. Fruits and nuts occupy an insignificant place in the food of the country people, although in some cities where transportation facilities are available the consumption of fruit at certain seasons is considerable. Meat is too expensive for the masses, and many people have it only at feasts. In a densely crowded country the pressure for human food crops is so great that there is little pasture for animals, and such types as may be raised are restricted to those like pigs and chickens that can subsist on refuse. Near the seashore and in the vicinity of canals and rivers, fish form an important element in the diet. The lack of a properly balanced food supply for most of the people often means that excessive quantities of rice or other starchy foods must be consumed.

The various cultivated crops not only furnish food but fuel as well. Rice or wheat straw, kaoliang stalks, and stubble are carefully collected and used in the cook stoves. Supplies of firewood are seldom available, but it is a common sight to see lines of people coming out from the hills laden with brush or roots that have been gathered from the denuded slopes. In Mongolia and parts of the northwestern provinces dried animal dung is widely employed for fuel, and its use for this purpose in some districts is in direct competition with its use as a fertilizer.

FIGURE 3.—A basketful of sticks, grasses, and roots—the harvest of a pathetic search for fuel and food in a drought-stricken field of northern Shantung. This early spring view in normal years should show the short blades of the winter wheat. (Courtesy China International Famine Relief Commission.)

THE AGRICULTURAL AREA

Agricultural statistics, like all figures in China, are difficult to secure or evaluate, and must be accepted with reserve. Few actual enumerations have ever been taken, and the available figures are often based on generalized and unedited estimates. Two series of comprehensive

TABLE I

CULTIVATED LAND AT DIFFERENT PERIODS

Year	*Dynasty*	*Cultivated Land in Mow*	*Population*	*Cultivated Land per Capita in Mow*
145 A.D.	Han	695,767,600	49,524,183	14.04
1490	Ming	423,805,800	53,281,158	7.95
1578	Ming	701,397,628	60,692,856	11.55
1661	Ching	549,357,640	104,707,086	5.24
1766	Ching	740,449,550	182,076,774	4.07
1872	Ching	819,453,194	329,563,216	2.49
1916	Republic	1,384,937,701	409,500,000	3.38

The first three figures are those quoted by Lieu, D. K., and Chen Chung-min in "Statistics of Farm Land in China," *Chinese Economic Journal*, March 1928; while the last four are listed by Chen Chang-heng, "Some Phases of China's Population Problem," *Bulletin de l'Institute International de Statistique*, Tome XXV, 2ème Livraison, Tokio (1931).

data by hsien or counties have appeared in recent years, one issued by the former Ministry of Agriculture and Commerce in Peking from 1914 onwards, known as "The Statistical Yearbook of Agriculture and Commerce" (in Chinese), and the other published in 1932 by the Directorate of Statistics of the Nanking Government under the direction of C. C. Chang, "Estimates of China's Farms and Crops," *Statistical Monthly* (Nanking), January–February 1932. Supplementing these nation-wide figures are scattered surveys of type areas, chiefly under the direction of J. Lossing Buck of the University of Nanking, who made his material available in "Chinese Farm Economy," published in 1930. A much more comprehensive survey by Buck is now under way. Agricultural

TABLE II

FARM LAND BY PROVINCES

Province	*Total Area Farm Land (in thousands of mow, 000 omitted) Ministry of Agriculture and Commerce, 1914*	*Ministry of Agriculture and Commerce, Revised by Lieu*	*Percentage of Total Area in Farms, After Lieu*	*Mow of Farm Land per Person, After Lieu*
Heilungkiang	32,493	36,537	9.7	6.8
Kirin	43,082	83,253		
Liaoning	48,994	44,408		
Jehol	15,340	16,246	19.4	3.5
Chahar	9,766	11,704		
Suiyuan	.....	5,525		
Ninghsia	.....	.....		
Hopei and Peking	90,432	94,140	43.	3.3
Shansi	46,855	49,821	44.3	4.2
Shantung	219,666	111,800	15.	3.0
Honan	343,495	140,000	4.6	3.6
Shensi	30,800	52,500	0.5	4.0
Kansu	23,090	26,700		
Sinkiang	10,916	10,700		
Chinghai	.....	.....		
Sikang	.....	.....	41.3	2.1
Kiangsu	85,390	74,000	40.	5.0
Anhwei	28,017	101,900	46.5	5.4
Hupei	126,680	154,500	15.	2.5
Szechwan	55,891	152,700	29.3	2.1
Chekiang	27,020	50,000	30.	3.5
Kiangsi	34,261	96,900	35.	3.3
Hunan	28,464	135,600	2.6	0.7
Kweichow	.....	8,300	3.8	2.3
Yunnan	10,456	26,000	15.	2.2
Fukien	16,810	32,300	20.	2.5
Kwangtung	22,592	92,900	21.9	6.4
Kwangsi	43,623	78,400		
Total	1,394,146	1,687,300	14.8	3.4

Data from Lieu, D. K. and Chen, Chung-min, "Statistics of Farm Land in China," *Chinese Economic Journal*, March 1928.

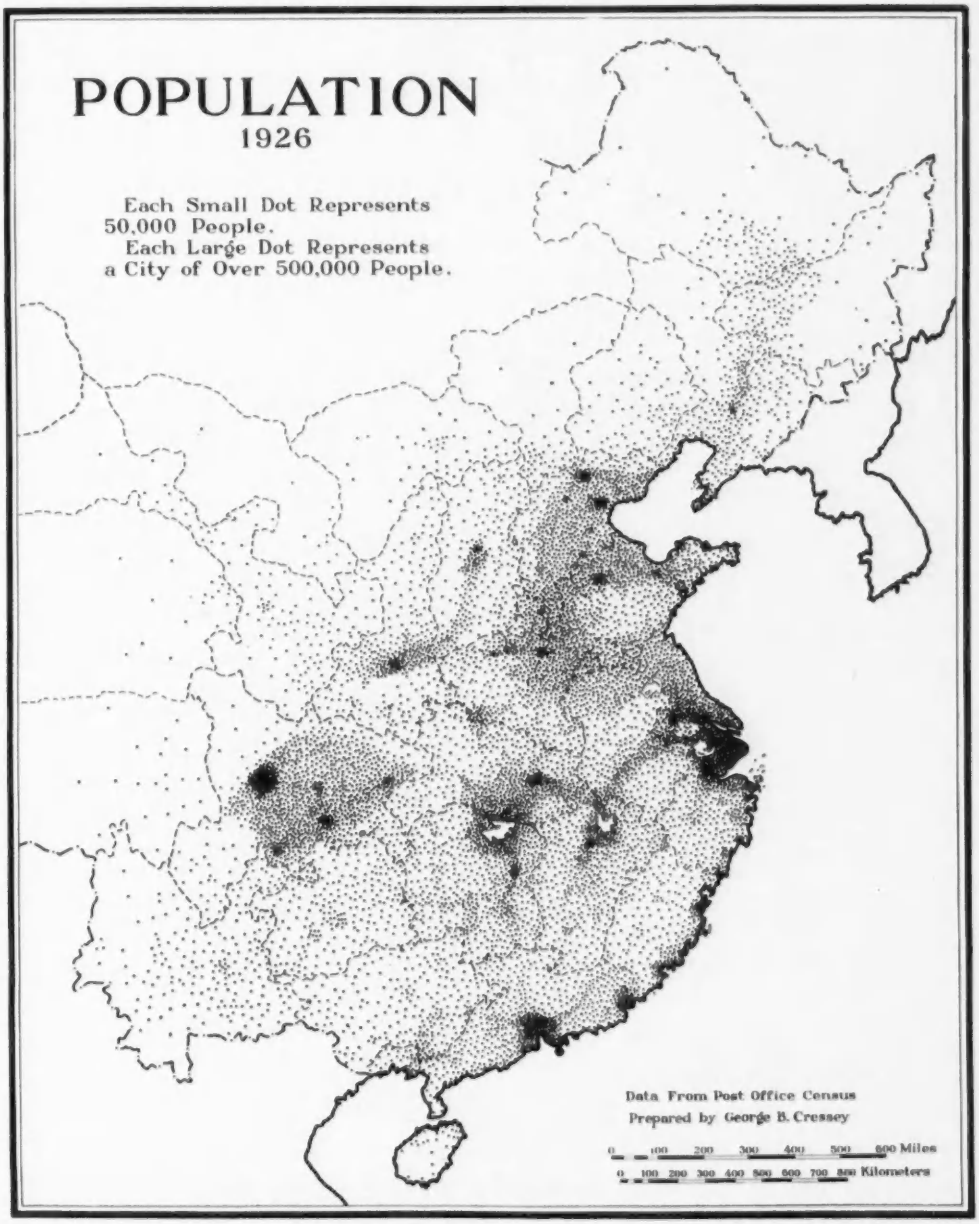
POPULATION
1926
Each Small Dot Represents
50,000 People.
Each Large Dot Represents
a City of Over 500,000 People.
Data From Post Office Census
Prepared by George B. Cressey
0 100 200 300 400 500 600 Miles
0 100 200 300 400 500 600 700 800 Kilometers

FIGURE 4.—The distribution of population, based upon the county estimates at the Post Office. The twelve cities with over 500,000 people are Peiping, Tientsin, Shanghai, Soochow, Nanking, Hangchow, Hankow, Chungking, Chengtu, Foochow, Canton, and Hongkong. The amazing coincidence between the distribution of arable land and population is strikingly shown in the similarity of Figures 4 and 5. Wherever the land will possibly yield food, there are the people. (From *China's Geographic Foundations.*)

enumerations have been taken at many times during the past 2,000 years, some of which are shown in Table I. While the area covered by these various census reports is not known, there is a striking contrast in the amount of cultivated land per person in the earlier and later years.

The statistics of the Ministry of Agriculture and Commerce are incomplete and need numerous corrections for ob-

vious errors. This editing has been undertaken by provinces by D. K. Lieu, and by geographic regions by the writer. The 1914 Ministry estimates and Lieu's revisions, generally based on 1917–1918, are given in Table II, the revised figures showing 14.8 per cent of the provincial area to be under cultivation with 3.4 mow of farm land per capita (one mow equals about one-sixth of an acre). The figures of the Ministry formed the bases of the original crop maps of Baker, LaFleur, and Foscue, which have been redrawn and extensively revised by the writer on the basis of field reconnaissance and conference in China.

The estimates of the Directorate of Statistics for 1932 are undoubtedly the most accurate available, but have not been critically analyzed or recombined into regions by the writer. They include data as to households, cultivated area, and the principal crops, some of which are presented in Table III. On the basis of these figures 74.5 per cent of the entire population of China is agricultural, with 21 mow of cultivated land per farm household. This figure represents the average size of the farms, which range from 103 mow in pioneer Heilungkiang to 21 mow in Hopei and 12 mow in tropical Kwangtung. Roughly a quarter of all cultivated land is irrigated, largely to the south of the Tsingling Shan and Hwai Ho. Wheat and rice are the leading crops in area, followed by soy beans, kaoliang, millet, barley, and corn. Chang's estimate of the total cultivated area in "average years" amounts to 1,248,781,000 mow or 208,130,000 acres. This is considerably less than Lieu's revision, but rather close to the writer's editing of the Ministry figures amounting to 1,260,000,000

TABLE III

CULTIVATED LAND AND CROPS BY PROVINCES [1]

Province	*Households*		*Percentage of Farm Households to Total*	*Area of Cultivated Land* (in thousands of mow, 000 omitted)		*Mow of Cultivated Land per Farm Household*
	Total Households	*Farm Households*		*Total*	*Irrigated*	
Heilungkiang [4]	624,468	489,927	78.5	50,475	382	103
Kirin	1,260,907	941,454	74.7	66,204	1,426	70
Liaoning	2,157,705	1,775,150	82.3	71,961	878	41
Jehol	547,473	437,232	79.9	17,546	240	40
Chahar	394,067	309,109	78.4	16,830	1,855	54
Suiyuan	367,452	249,727	68.0	18,630	1,400	75
Ningshia	76,059	54,159	71.3	2,004	1,426	37
Hopei	4,938,706	4,223,704	85.5	103,432	8,467	24
Shansi	2,263,408	1,874,082	82.8	60,560	3,629	32
Shantung	6,659,858	5,918,280	88.9	110,662	2,395	19
Honan	6,029,066	5,061,700	84.0	112,981	7,802	22
Shensi	1,896,926	1,384,579	73.0	33,496	3,111	24
Kansu	1,075,880	793,160	73.7	23,510	3,861	30
Sinkiang [2]	512,316	344,111	67.2	13,692	No data	40
Chinghai	No data	No data	No data	No data	No data	No data
Sikang	No data	No data	No data	No data	No data	No data
Kiangsu	6,438,036	5,056,536	78.5	91,669	35,574	18
Anhwei	3,788,764	2,682,248	70.8	53,511	20,830	20
Hupei	5,771,373	3,959,690	68.6	61,010	26,274	15
Szechwan	7,263,538	4,975,252	68.5	96,272	42,222	19
Chekiang	4,559,540	3,164,857	69.4	41,209	29,806	13
Kiangsi	4,942,249	3,292,310	66.6	41,630	23,660	13
Hunan	5,537,680	3,899,715	70.4	45,612	28,844	12
Kweichow [4]	1,769,023	1,193,488	67.5	23,000	9,513	19
Yunnan [3]	1,947,021	1,383,924	71.1	27,125	12,036	20
Fukien	2,287,645	1,625,684	71.1	23,290	11,988	14
Kwangtung	5,459,096	3,479,103	63.7	42,452	24,690	12
Kwangsi	No data	No data	No data	No data	No data	No data
Total	78,568,245	58,569,181	74.5	1,248,781	302,309	21

[1] Data from Chang, C. C., "Estimates of China's Farms and Crops," *Statistical Monthly* (Nanking), January–February 1932.

[2] Figures for Sinkiang represent only 56 hsien; 10 hsien are not included.

mow or 210,000,000 acres for the 28 provinces.

China is an old and stabilized country where man has occupied almost every corner that can and will produce food. The climax character of this adjustment is shown by a comparison of the maps of cultivated land and population. They are so much alike that one might almost be substituted for the other. Area for area there is a parallelism in the density of population and the acreage of crop land. The areas of concentration are the great plain of the Hwang Ho, the crescentic series of grabens through Shansi and Shensi, the Yangtze lowland including the Poyang and Tungting lake basins, central Szechwan, and the Canton delta. Even central Manchuria shows a density which indicates that the days of pioneer expansion will soon be over. Where the dots for population are widely spaced, as along the Mongolian and Tibetan frontiers, the sparsity is accounted for by the corresponding scattering of cultivable land. If there were more agricultural land there would be more people, and the absence of people is strong indication that they cannot live there—at least under the techniques available to the industrious and ever resourceful Chinese farmer.

CROPS

The Directorate of Statistics supply data as to the area and total yield of various crops, from which it is possible to derive acre yields. These are given in Table IV along with comparative figures from Buck's surveys of 2,866 farms in seven provinces of north and east central China, as well as world averages computed from the International Yearbook of Agriculture. On the basis of the incomplete reports of the Peking Ministry of Agriculture and Commerce, O. E. Baker in his "Land Utilization in China," presented before the Pan-

TABLE III—(*Continued*)

Crop Area

(in thousands of mow, 000 omitted)

Wheat	*Rice*	*Soy Beans*	*Kaoliang*	*Millet*	*Barley*	*Corn*	*Province*
9,602	116	15,602	8,262	10,152	1,891	2,672	Heilungkiang
9,332	1,945	21,771	13,373	11,974	1,646	3,569	Kirinl
2,775	2,158	15,804	24,244	10,466	1,230	9,206	Liaoning
850	136	1,553	5,231	7,250	235	322	Jehol
1,640	158	1,025	1,652	3,350	664	418	Chahar
2,679	No data	No data	1,997	4,109	974	51	Suiyuan
503	348	78	109	236	78	17	Ningshia
31,326	601	9,804	21,659	24,330	3,943	15,502	Hopei
16,520	299	3,248	9,814	18,429	2,139	4,065	Shansi
49,688	196	29,910	22,239	21,156	3,670	5,983	Shantung
59,528	4,029	14,352	15,439	19,220	10,373	8,626	Honan
14,829	2,913	2,204	1,983	4,941	3,176	3,772	Shensi
8,659	449	1,294	1,531	3,554	2,513	1,287	Kansu
4,710	1,676	149	747	334	626	2,638	Sinkiang
No data	No data	No data	No data	No data	No data	No data	Chinghai
No data	No data	No data	No data	No data	No data	No data	Sikang
42,127	31,641	19,332	6,736	1,575	22,210	3,926	Kiangsu
21,295	23,221	8,843	5,052	429	7,140	507	Anhwei
18,748	24,452	5,280	3,659	2,270	10,234	6,538	Hupei
18,437	45,747	7,599	5,544	984	8,236	12,751	Szechwan
8,996	27,982	2,920	131	595	4,566	1,105	Chekiang
4,389	32,190	4,618	142	760	2,215	80	Kiangsi
3,444	26,490	2,962	1,465	813	1,984	1,790	Hunan
2,645	11,924	2,308	663	691	1,921	3,176	Kweichow
4,443	13,655	2,671	718	643	2,047	3,888	Yunnan
4,027	16,769	1,639	19	1,039	698	No data	Fukien
1,199	52,371	1,562	178	795	340	142	Kwangtung
No data	No data	No data	No data	No data	No data	No data	Kwangsi
342,371	321,566	176,528	152,587	150,095	94,749	92,031	

[3] Four hsien of Yunnan are not included.

[4] One hsien of Heilungkiang and Kweichow are not included.

TABLE IV

CROP YIELDS [1]

Product	Production, Millions of Pounds	Yield per Mow, Catties	Yield per Acre		Yield per Acre After Buck, [3] Bushels	World Yield per Acre [4]
			Pounds	Bushels [2]		
Rice	130,312	271	2,433	54	51.9	32 bu.
Wheat	56,449	124	989	16	14.9	14 bu.
Sweet potatoes	35,745	992	7,497	139	....	(95 bu.)
Kaoliang	31,154	159	1,225	22	18.5	.....
Soy beans	30,779	131	1,046	17	12.4	(13.7 bu.)
Millet	28,965	144	1,158	21	23.0	.....
Corn	19,704	161	1,284	23	11.9	24 bu.
Barley	17,093	135	1,082	28	17.7	20 bu.
Sugar cane	6,489	1,577	12,576	..	....	(26,600 lb.)
Peanuts	5,843	249	2,009	..	....	(669 lb.)
Irish potatoes	5,393	751	6,005	100	....	143 bu.
Cotton	2,171	25	204	..	....	161 lb.
Rape seed	1,543	106	847	..	24.4	482 lb.
Tobacco	464	161	1,288	..	....	776 lb.

[1] Derived from data in *The Statistical Monthly*, Nanking, January–February 1932, pp. 2–4, except as in footnotes 3 and 4.
[2] A bushel is figured as 60 pounds of wheat, soy beans, and Irish potatoes, 56 pounds of kaoliang, millet, and corn, 54 pounds of sweet potatoes, 48 pounds of barley, and 45 pounds of rough rice.
[3] Buck, J. Lossing, "Chinese Farm Economy," p. 204. Average of 2,866 farms in seven provinces of north and east central China.
[4] Pre-war averages derived from International Yearbook of Agriculture, Rome, 1930–31. Figures in parentheses are not available on a world basis and are United States averages from the United States Yearbook of Agriculture, 1930.

Pacific Conference at Honolulu, 1927, and published by the University of Chicago Press in 1928, concluded that China's average acre yields of five cereals were 20 per cent lower than in the United States. On this basis he postulated a considerably larger crop yield with more efficient agriculture. This comparison does not appear in these newer figures, for China exceeds American averages in everything but corn and Irish potatoes, and is likewise considerably above the level of world yields.

China probably leads the world in total agricultural production. The country appears to hold first place among all nations in rice, wheat, sweet potatoes, kaoliang, soy beans, millet, barley, peanuts, tea and silk. Despite the importance of agriculture, however, China fails to produce enough food for her own population and each year imports large quantities of sugar, rice, and wheat.

Rice is the outstanding agricultural product and forms the staple food for the people of South China. Although rice will mature as far north as Vladivostok, only limited quantities are raised in North China, that is north of the Tsingling Range and Hwai Ho. The comparative absence of rice in the North is partially due to the sandy soil and the scarcity of water for irrigation, as well as to custom. Rice can be grown without flooding, but the yield is small, and only an insignificant part of the total production is obtained in this way. There are tens of millions of people in North China who do not taste rice more than once or twice a year. In the South, however, rice is eaten at almost every meal.

Rice is first grown in seed beds, and when a foot high is transplanted to flooded fields where it matures in about a hundred days. One crop a year is grown in the Yangtze valley and two, or even three, in the extreme south. The average yield of 54 bushels per acre is nearly twice the world average. This figure is very close to that of Japan, and nearly three times the yield of India and Java.

Wheat exceeds rice in acreage but not in total production. It is raised in all parts of the country, although North China is the most important area, and little is grown south of the Yangtze valley. Throughout South China and in

the plains as far north as the Great Wall, wheat is a winter crop, whereas in Manchuria and the northwest it is planted in the spring and forms the main crop of the year. Raised bread is seldom eaten, and wheat flour is used for noodles, boiled dumplings, and unleavened biscuits. Wheat yields approximate those of the United States, but are less than half those of western Europe. On the basis of the Nanking statistics, China appears to have a slight lead over the

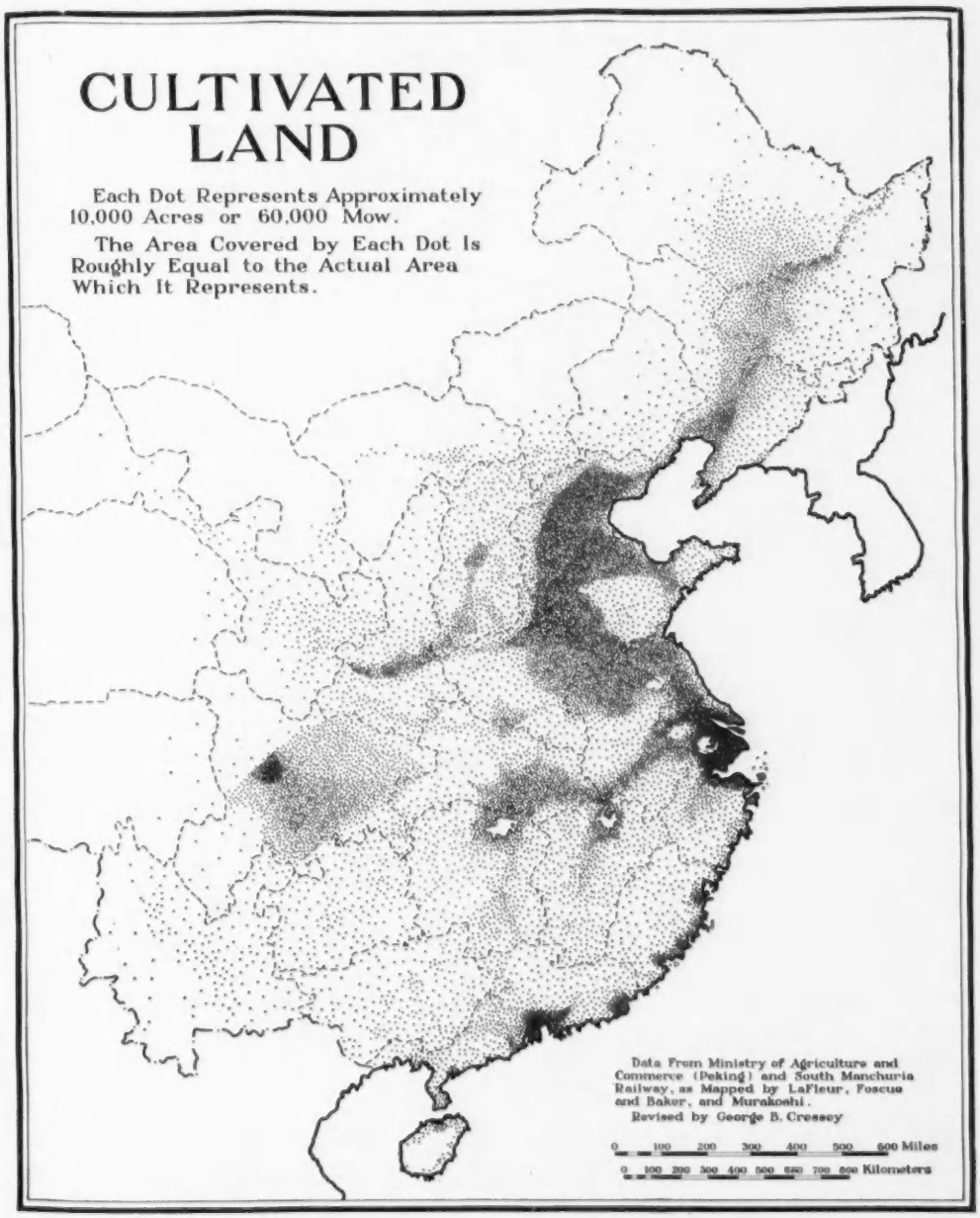
CULTIVATED LAND
Each Dot Represents Approximately 10,000 Acres or 60,000 Mow.
The Area Covered by Each Dot Is Roughly Equal to the Actual Area Which It Represents.
Data From Ministry of Agriculture and Commerce (Peking) and South Manchuria Railway, as Mapped by LaFleur, Foscue and Baker, and Murakoshi.
Revised by George B. Cressey
0 100 200 300 400 500 600 Miles
0 100 200 300 400 500 600 700 800 Kilometers

FIGURE 5.—The location of cultivated land closely reflects the usability of the land forms. Note especially the vast delta plain of Hwang Ho, the grabens of Shansi and Shensi, lake basins along the Yangtze, the Chengtu plain, and the Canton delta. Mountains and deserts limit cultivation in the west and north respectively. (From *China's Geographic Foundations.*)

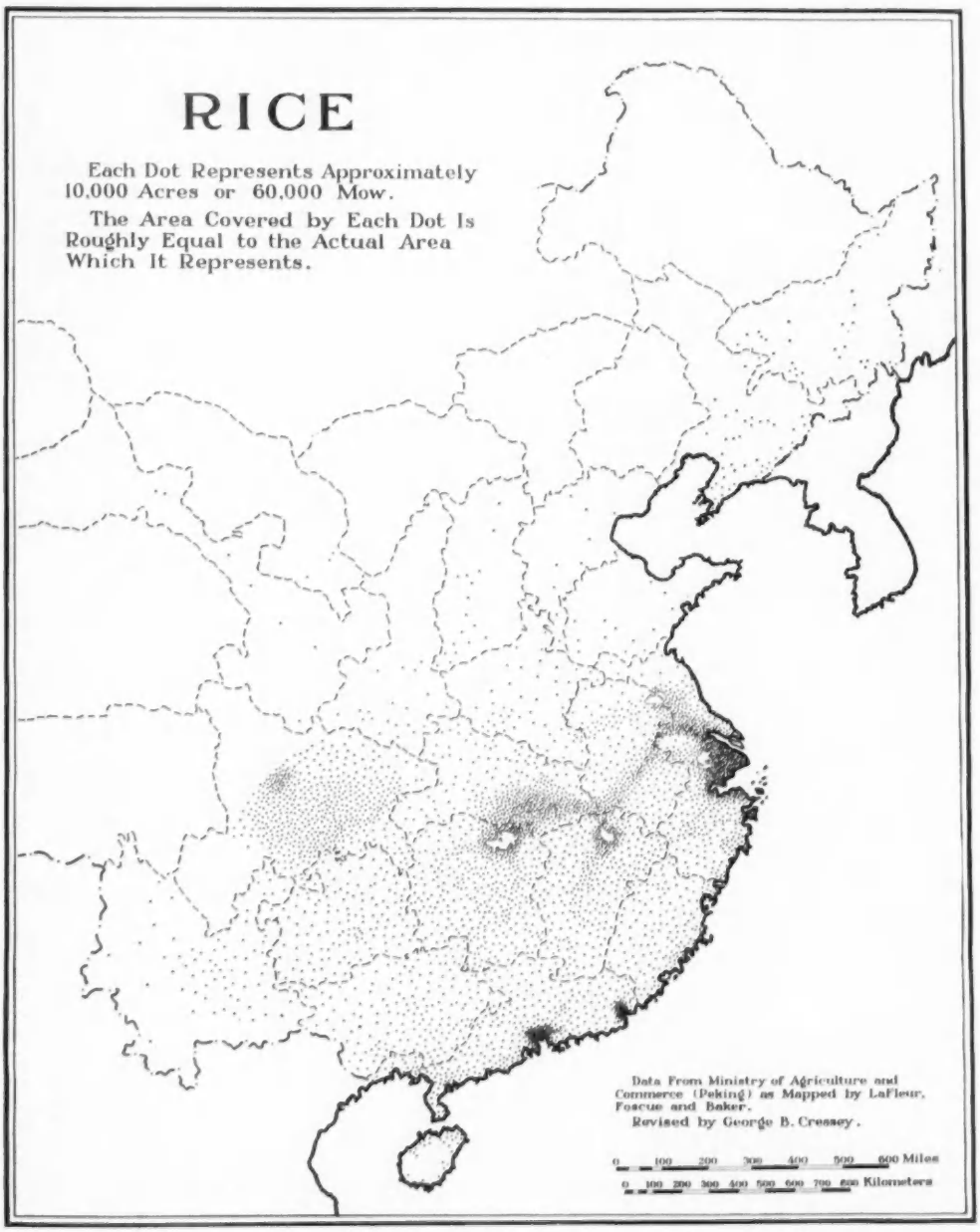
RICE
Each Dot Represents Approximately 10,000 Acres or 60,000 Mow.
The Area Covered by Each Dot Is Roughly Equal to the Actual Area Which It Represents.
Data From Ministry of Agriculture and Commerce (Peking) as Mapped by LaFleur, Foscue and Baker.
Revised by George B. Cressey.
0 100 200 300 400 500 600 Miles
0 100 200 300 400 500 600 700 800 Kilometers

FIGURE 6.—Rice is the standard crop of South China wherever water is available from summer rains or by irrigation. The cultivation northward is limited by diminished rainfall, sandy or calcareous soils, and custom. (From *China's Geographic Foundations.*)

United States and Russia in total production.

Millet and the grain sorghum, kaoliang, take the place of rice in the dry north, and are grown as summer crops. Although their distribution is somewhat similar, the plants themselves are quite unlike, for kaoliang resembles tall broom corn. These grains are used both for man and for domestic animals.

Soy beans are the magic crop of Chinese agriculture. Although they have

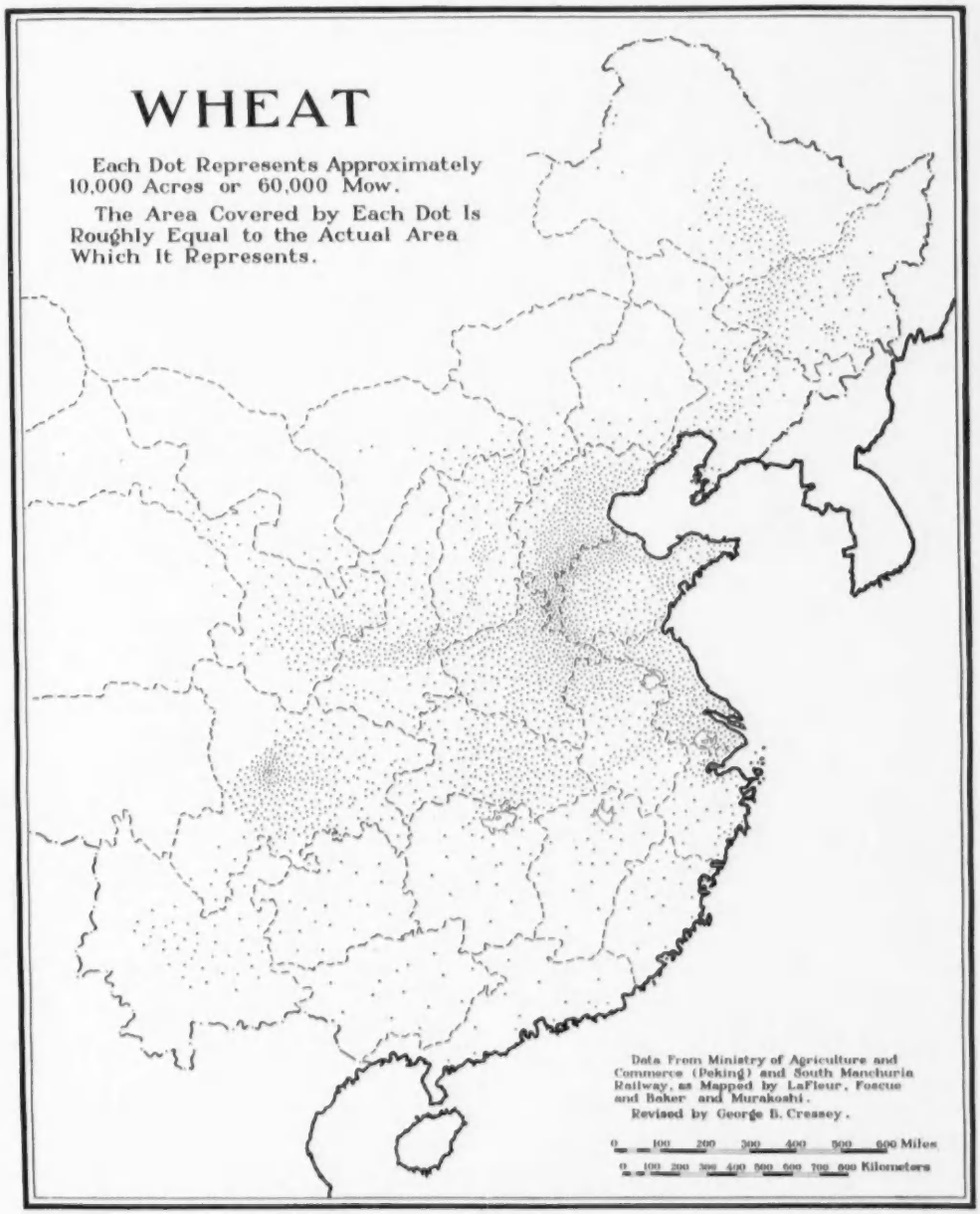
WHEAT
Each Dot Represents Approximately 10,000 Acres or 60,000 Mow.
The Area Covered by Each Dot Is Roughly Equal to the Actual Area Which It Represents.
Data From Ministry of Agriculture and Commerce (Peking) and South Manchuria Railway, as Mapped by LaFleur, Foscue and Baker and Murakoshi.
Revised by George B. Cressey.
0 100 200 300 400 500 600 Miles
0 100 200 300 400 500 600 700 800 Kilometers

FIGURE 7.—Wheat is widespread throughout the North and in the Yangtze valley. Its appearance in Manchuria reflects Russian influence. (From *China's Geographic Foundations.*)

been grown throughout China on a small scale for many centuries, it is only in recent years that their manifold uses have been appreciated. They now form one of the largest items in China's foreign trade, with central Manchuria as the chief producing area. In China soy beans are used in the preparation of cooking oil, bean curd, and other foods. The exported oil is used in a great variety of industrial processes and the bean cake serves as a fertilizer or as a feed for cattle.

Chinese cotton is largely of the short

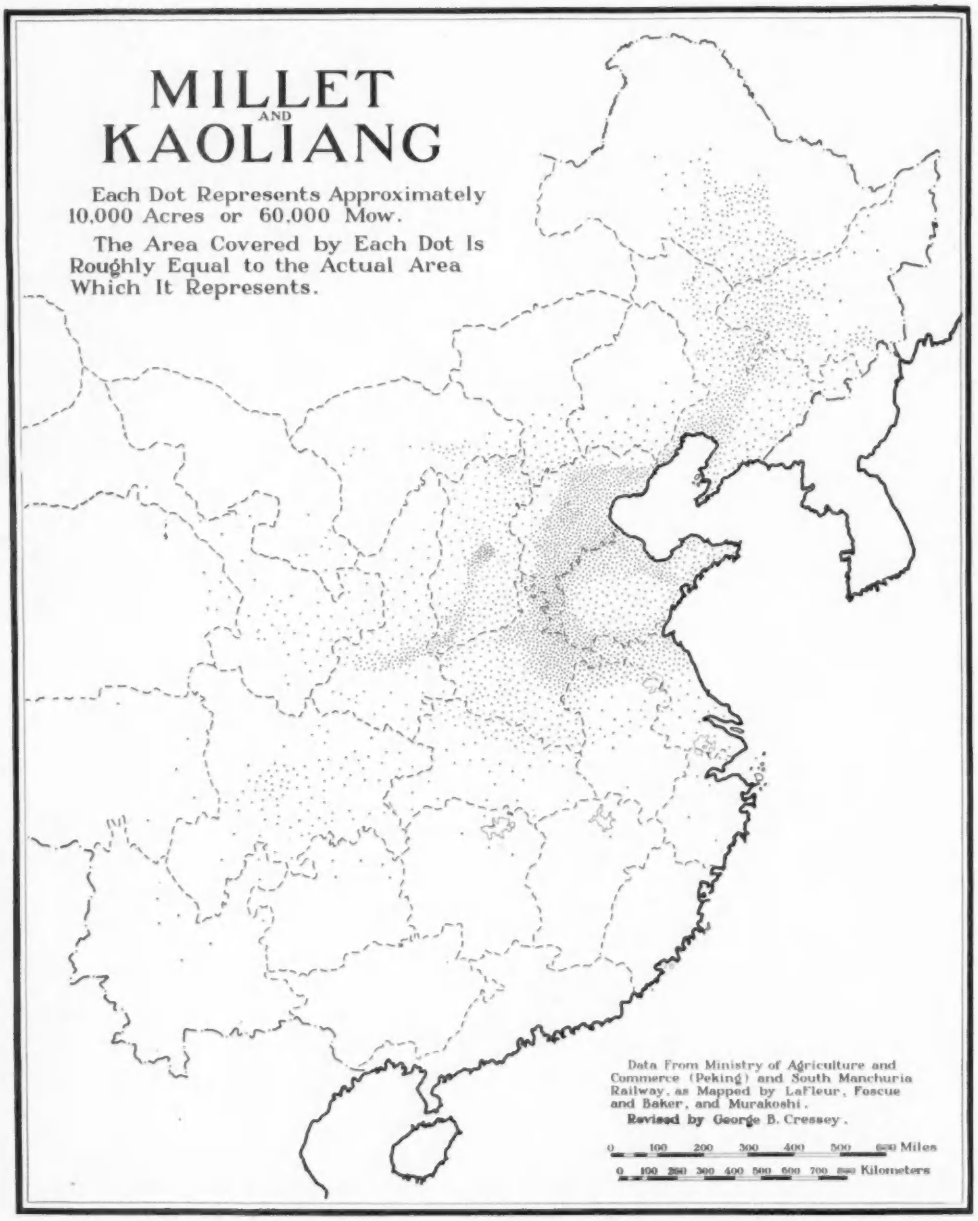
MILLET AND KAOLIANG
Each Dot Represents Approximately 10,000 Acres or 60,000 Mow.
The Area Covered by Each Dot Is Roughly Equal to the Actual Area Which It Represents.
Data From Ministry of Agriculture and Commerce (Peking) and South Manchuria Railway, as Mapped by LaFleur, Fescue and Baker, and Murakoshi.
Revised by George B. Cressey.
0 100 200 300 400 500 Miles
0 100 200 300 400 500 600 700 Kilometers

FIGURE 8.—Millets and the grain-sorghum, kaoliang, are staple crops of the dry North, seldom extending south of Hwai Ho and Tsingling Range. Their distribution is not everywhere the same, for kaoliang is more important in Manchuria and millet is somewhat more common in the northwest. (From *China's Geographic Foundations.*)

staple varieties. Originally grown in the Loess Highlands, the leading area is now the eastern Yangtze Plain and the western part of the North China Plain. Import of long staple cotton is about balanced by export of Chinese-grown cotton.

FUTURE DEVELOPMENTS

Oriental agriculture has been widely heralded as intensive and efficient. In terms of acre yields this may be true. Such productivity, however, is the result

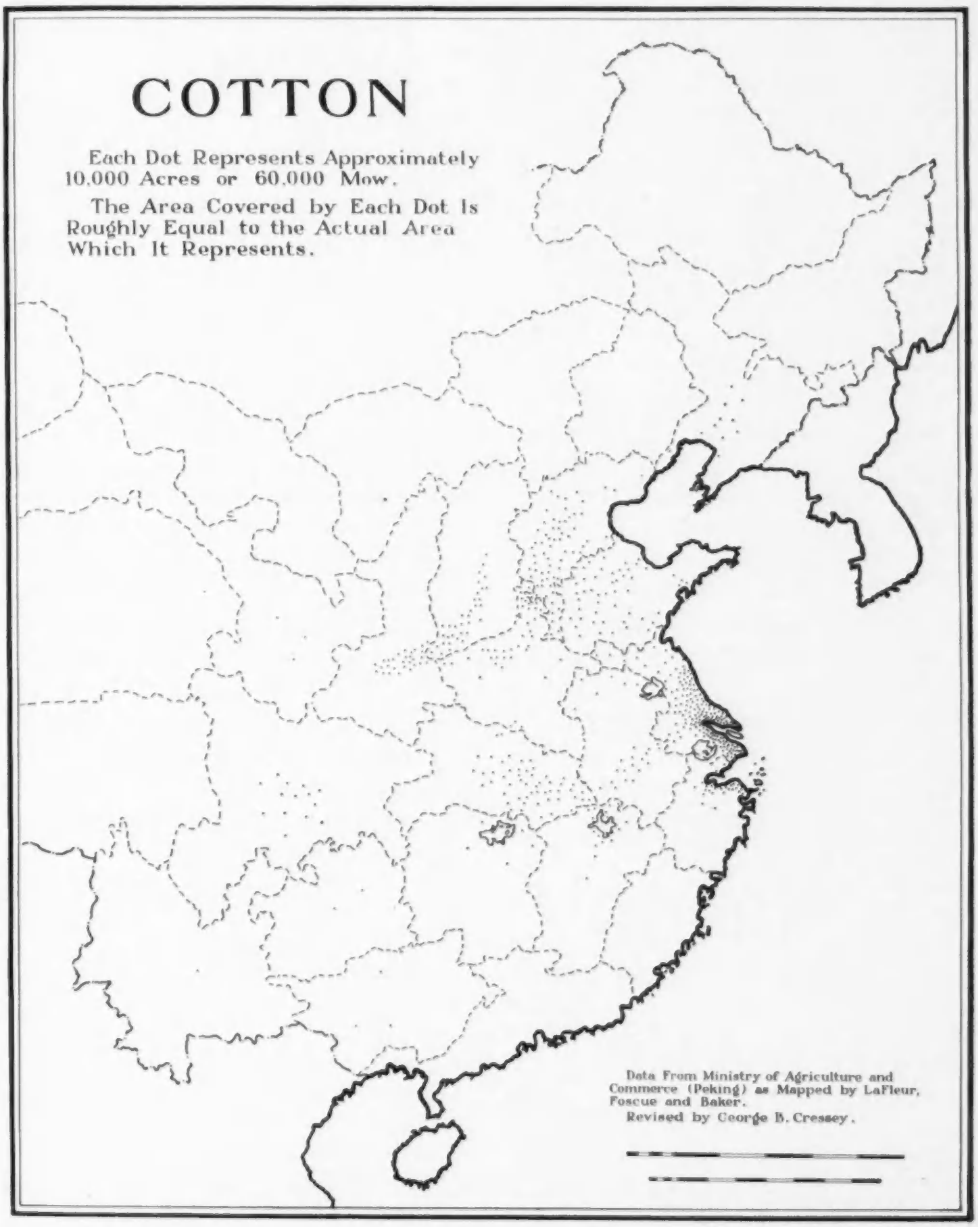
COTTON
Each Dot Represents Approximately 10,000 Acres or 60,000 Mow.
The Area Covered by Each Dot Is Roughly Equal to the Actual Area Which It Represents.
Data From Ministry of Agriculture and Commerce (Peking) as Mapped by LaFleur, Foscue and Baker.
Revised by George B. Cressey.

FIGURE 9.—Cotton was first raised in the far northwest, later introduced into the North China Plain, and now most extensively grown in the Yangtze delta. Most of the cotton is short staple. Tientsin and Shanghai are the chief market and mill centers.

of a laborious cultivation that is very wasteful of human effort. Excessive amounts of time and care are bestowed upon tiny scattered fields, and the commendable production is secured only at the expense of a small per capita farm area. After all, it is not the yield per mow but the yield per mouth that counts.

Most of China is an old land of stabilized agriculture with the soil cultivated so near to the economic limit that larger crop yields are difficult to secure. Pio-

neering possibilities are present only in the far North and Northwest, and even in these areas they are distinctly limited. Some expansion of crop land may be possible through drainage of swamps and the irrigation of new lands, both in the semi-arid North and on the hill slopes of the South. Commercial fertilizers and mechanical or animal power on the farms might assist, but may not be financially feasible. Better seeds and improved farm management will contribute materially, and probably hold the most significant promise of improvement in general livelihood. None of these possibilities, however, appears to offer an opportunity for adequate expansion.

Agriculturalists who have traveled widely in China agree that the pressure of population has pretty generally resulted in the utilization of all arable land up to its economic limit. Colonization on any significant scale is impossible. It would appear that one of China's most pressing problems thus concerns the relation between limited productivity and expanding population.

AGRICULTURAL REGIONS

Various attempts have been made to divide China into regions of agricultural significance. Among these are the climatic subdivisions of Chu Co-ching and Chapman, the agricultural regions of Nyhus, and the geographical regions of Cressey and others. All of these inevitably suffer because of inadequate statistical and observational information and the general absence of satisfactory maps.

Most authorities recognize the major contrasts between the green humid South with its canals, rice fields, and water buffalo, and the brown semi-arid North with its unirrigated crops of kaoliang, millet, and wheat. The boundary between these two Chinas is marked by the Tsingling Mountains in the west and Hwai River (Hwai Ho) in the east. South China is sub-tropical, while the North is at times semi-desert. Out of these contrasts have developed sharp differences in crops, agricultural methods, cultural patterns and political outlook.

The regional survey here presented is based upon the divisions of the writer, supplemented by material from the work of Mr. Paul O. Nyhus, "Cropping Systems and Regional Agriculture in China," mimeographed by the U. S. Bureau of Agricultural Economics in 1931. Mr. Nyhus has traveled widely in China as Agricultural Commissioner of the United States Department of Agriculture, and is one of the principal authorities on Chinese agriculture. In addition to his own observations, Nyhus collected data on cropping systems from 190 mission stations scattered throughout China, and has used this material to provide a comprehensive account of regional agriculture. Since the study is available only in mimeographed form, extensive quotations are here included, through the kind permission of Mr. Nyhus. Inasmuch as the regions proposed by Nyhus do not entirely coincide with those of the writer, certain discrepancies are to be noted.

The following summary paragraphs from the report of Nyhus present his point of view:

"It appears that pressure of population upon the food supply has caused a considerable adjustment of the diet of the people to the cereals which seem to thrive best in each region. In turn, accordingly, rice, wheat, millet, corn and oats are each principal food items in regions where each thrives. The popular Western conception, therefore, that rice is the leading cereal in the diet of all the Chinese is only partially true since in North China very little rice is grown and accordingly consumed. Primitive and inadequate transportation facilities, moreover, have limited the movement of products between distant communities and the cropping system does not appear to be greatly influenced by distant markets. Farm production is very

largely food production for the local community. The absence, moreover, of major live stock industries eliminates pasture and hay crops and enables most of the crop land to be utilized for grains in the production of a human food supply.

"North China, or non-rice producing country, is one of the major divisions of China on the basis of its cropping practices. Within the North, moreover, are a number of regions with different cropping practices. Stretching across the Northern or Mongolian boundary and including Manchuria are regions where low winter temperatures combined with arid conditions prevent the growing of winter crops and confine agriculture to summer crops. Manchuria with its 'big three' of soy beans, kaoliang, and millet, Northern Shansi with twelve to fifteen inches of annual rainfall and more than half the cultivated land in millets, and the highlands of Kansu with millets, spring wheat, peas and oats, are separate agricultural regions along the Northern boundary. To the southward and extending to the Yangtze River basin, however, conditions favor winter wheat as the leading crop and 50 to 70 per cent of the cultivated land is sown with wheat in September and harvested in early June. To the east in this same section on the Great Plain of China there are spring-planted crops of kaoliang (a grain sorghum), millet, and cotton, and summer-planted crops which follow the wheat harvest of soy beans, millets, corn, sweet potatoes, and peanuts. Farther west, however, in a region of eighteen inches of annual rainfall much of the wheat land remains fallow during the summer months" (p. 1).

"A belt east and west across Central China in the Yangtze Basin and including Western China, is another major region in the subdivision of agricultural conditions into North China, Central China, and South China. The boundary in the North is the Tsin Ling Range of mountains and a line following the Hwai River toward the ocean,—south of which, as previously indicated, soil and rainfall conditions enable rice culture. Winter cropping, similar to the North, continues. Along the northern boundary rainfall is somewhat scant for rice and rice fields are restricted to valleys and low-lying terraces which are irrigated with water collected and stored in ponds. But the lines of equal rainfall run east and west across China in the Yangtze Valley and, proceeding southward, the rainfall increases very sharply; enables more and more rice; and finally favors two crops of rice and eliminates winter cropping. The southern boundary accordingly is the approximate southern boundary of extensive or relatively important winter cropping. In the nature of things it is by no means a clearly defined boundary, since substantial acreages of the various winter crops of rape seed, beans, and wheat occur on mountain sides or in the valleys as far south as Canton, but in general the boundary east and west across Central Chekiang and Northern Kiangsi and southward across Western Hunan indicates the change to the quite exclusive rice country to the southeast. From east to west are included the canal and delta lands of Kiangsu and Chekiang Provinces, flat flood lands and rolling lands of Central China, and finally the mountainous country of Western China.

"In spite of the geographical extent of the region and the differences in climate, topography and soils the cropping systems of the entire region have certain basic similarities. Winter cropping is very general and the summer crops consist of as much rice as irrigation or water facilities will permit, and of corn, cotton and beans in varying amounts in different districts. Rainfall conditions would somewhat justify north and south subdivisions, but three east and west subdivisions have been made based largely on topography and irrigation facilities and the resulting extent to which rice or other summer crops are grown" (pp. 35–36).

"Southeast China is cut up by numerous mountain ranges and hills, and agriculture is quite largely confined to plains and valleys along the numerous rivers and streams and to delta lands at the mouths of the rivers. Along the coast there is a high mountain range which divides the river systems and the provinces along the coast from the interior valleys of the Kan and Siang Rivers, both draining into the Yangtze and running north and south through the provinces of Kiangsi and Hunan respectively. In the South the drainage basin of the West River includes much of Kwangtung and Kwangsi Provinces. In Western Hunan and Kwangsi the country becomes more mountainous, and agricultural conditions gradually change to those described for Western China. The valleys are at a uniformly low altitude, and the location of the region between a latitude of 28 degrees on the north to 22 degrees on the south gives it tropical or semi-tropical growing conditions. Temperatures are high and during

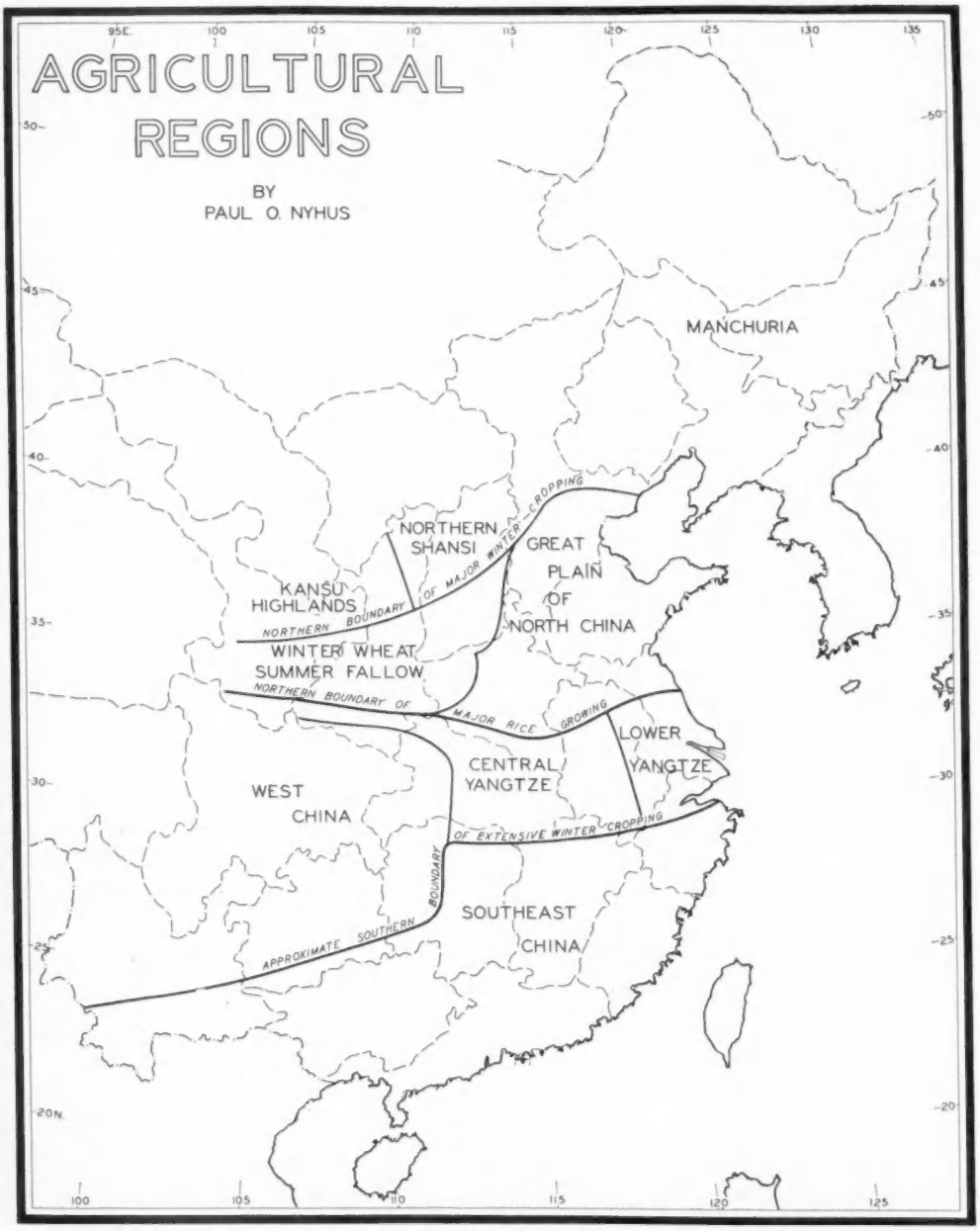

FIGURE 10.—The agricultural regions of Nyhus are based upon returns from widely distributed questionnaires supplemented by field observations over several years.

the rainy season the rainfall is especially abundant.

"From a cropping standpoint it is primarily a rice-growing region, although in Kiangsi substantial amounts of rape seed and in some localities winter wheat are grown during the winter. There are varying amounts throughout the region of sweet potatoes, sugar cane, beans and other crops during the summer or autumn. It is difficult in describing prevailing cropping practices to generalize for a particular province in this region. The variety of conditions in each,—irrigated and non-irrigated plains, narrow and wide valleys with and without water supplies for a second crop of rice, plain and mountainside farming

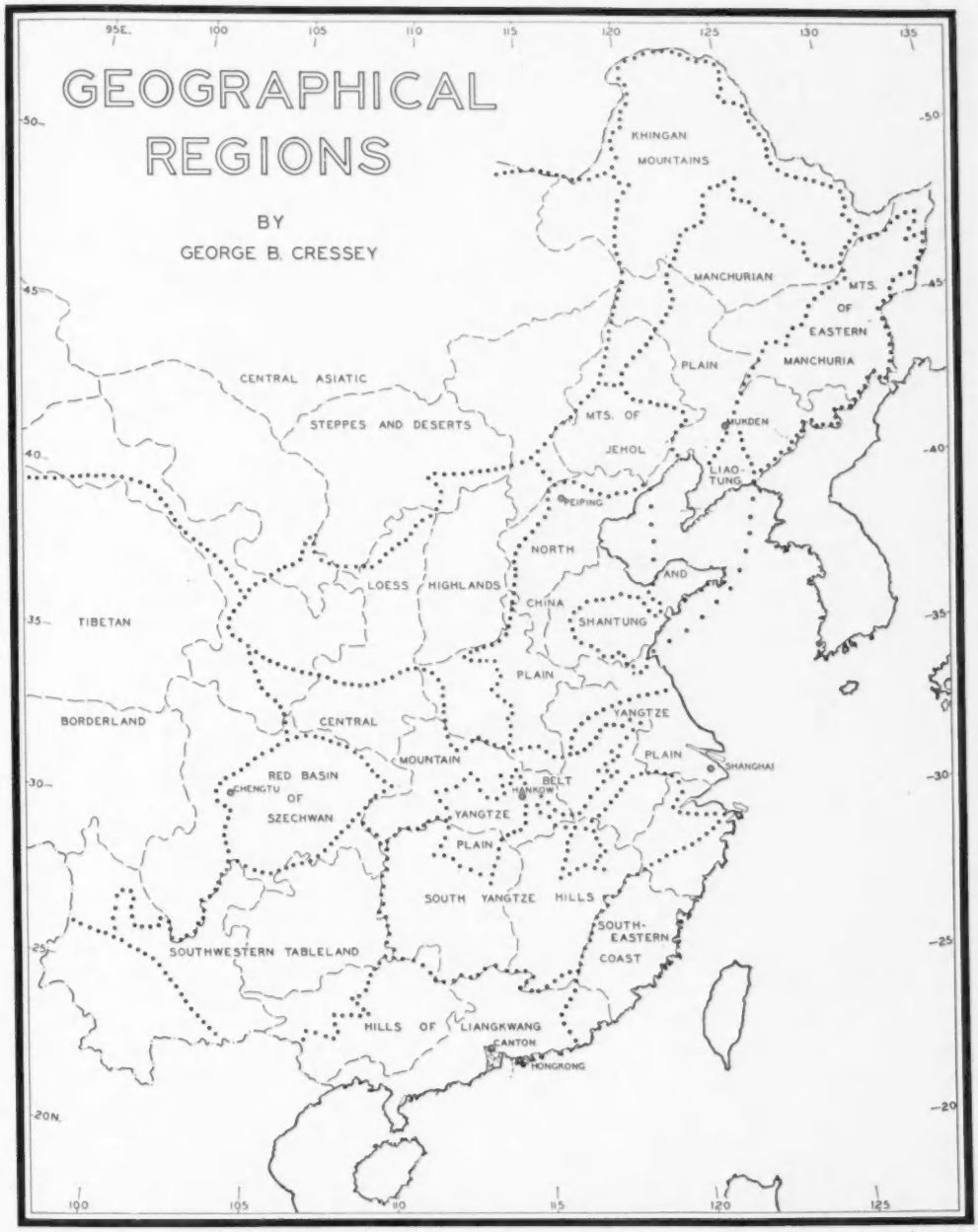

FIGURE 11.—Geographic factors of land forms, climate, agriculture, and usability divide China into fifteen regions, within which there exists essential similarity of adjustments. (From *China's Geographic Foundations.*)

and other varying conditions,—have given rise to variations in the cropping system to suit local conditions. In general, however, winter cropping is of very minor importance and two crops of rice in one year are grown if rainfall or irrigation facilities permit" (pp. 52–54).

THE NORTH CHINA PLAIN

This vast expanse of level land is the gift of Hwang Ho and the other streams that flow out from the encircling mountains. These rivers have built a great

delta into what was once an arm of the sea. In many places, the beds of the streams are now several feet above the level of the surrounding country. When the dikes fail, vast areas are flooded and famine ensues.

The North China Plain is clearly defined on all sides except the southeast, where the plain merges with that of the Yangtze. The southern limit of the geographical region is marked by a distinct change in climate, soil, and agriculture that roughly follows Hwai Ho.

FIGURE 12.—Threshing wheat with a flail in North China recalls Biblical parallels, and suggests the cultural affinities of all Asia. (Courtesy The Photo Bureau.)

This region is the home of a crowded and industrious agricultural population. With an area of 125,078 square miles, considerably smaller than that of California or Japan, the Post Office estimates for 1926 show a population of 80,979,025. This gives a population density of 647 people per square mile, probably 90 per cent of whom obtain their livelihood directly from the soil.

Man lives very close to nature in this fertile plain. His chief concern is food, and that is dependent upon rainfall. Unfortunately, the precipitation is limited and uncertain, the average amounting to but twenty inches a year. Often the total falls much below this or comes too late to be of value for crops, or is so concentrated as to produce floods. Agriculture is thus precarious and crop failures are frequent. Man has so crowded the land that little surplus can be accumulated for the bad years. Famines have been recurrent and devastating.

The region has played a leading rôle in China's history. It has been the seat of most of the great dynasties, and is the home of Confucius and the sages.

"Various crops vary in importance in different localities but, considering its extent, the region would probably be considered quite uniform agriculturally. A Chinese expression, 'three harvests in two years,' describes the cropping practice. One-half to three-fourths of the land is sown to winter wheat in October, the less amount in the North and the larger amount in the South. To the South there are additional amounts of barley and of peas. Broad beans make their appearance along the coast. The extent of fall sowing leaves about one-fifth to one-third of the land available for crops planted in April. Kaoliang—a grain sorghum—is the leading spring-planted crop, 15 per cent or more in most localities. Spring-planted millet is sown on 10 to 20 per cent of the land in the North, but less than 10 per cent in the southern half of the Plain. Small percentages of cotton are general, with some districts in the North growing 20 per cent or more. This is all short staple or rough cotton, much of it unfit for spinning purposes and of which substantial amounts are exported to the United States and Japan as rough cotton because of its wiry properties.

"Following the wheat harvest in late May or early June, the land is immediately replanted to summer crops. Oftentimes the summer crops are planted between rows of winter grain, and in the North when the wheat is harvested the corn may already be eight or ten inches high. Summer cropping on the northern part of the Plain differs somewhat from the South. In the North, corn is the leading summer crop, but with millet of equal importance in many localities. Twenty to 30 per cent of corn seems to be general. Soy and mung beans growing alone probably represent a smaller production than the amounts secured from interplanting with corn, kaoliang and millet. In the North, after the corn is harvested in early September most of the fields have a thin stand of black,

FIGURE 13.—The demands for fuel and fertilizer compete for the available animal wastes. These cakes of water buffalo dung are mixed with straw and plastered on the walls to dry into briquettes. Typical farm houses in Anhwei, in the North China Plain. (W. C. Lowdermilk, Courtesy University of Nanking.)

soy or mung beans which, with the corn off, come to maturity in a few weeks. South of the Yellow River, corn and millet are very minor crops and soy beans are very prominently the leading crop. Roughly, half of the land in beans is the general situation. Bean varieties consist chiefly of yellow and black soy beans and (green) mung beans, with the yellow soy probably three-fourths of all south of the Yellow River and black most popular farther north. Sweet potatoes is the next most general crop, but varying in importance from 5 to 20 per cent in different localities. Substantial amounts of peanuts both in the North and South, and 5 to 10 per cent of sesame, particularly in Honan, completes the essential crops. Sesame seed is exported in large amounts to foreign countries, and the oil expressed from the seed is widely used in China as a cooking oil. There are localities where tobacco production is considerable, and near Weihsien there is a district developed by a foreign tobacco company where production of flue-cured tobacco from American seed has reached 40,000,000 pounds. There are other districts in Anhwei and Honan. In the South it will be noted that the extensive growing of a legume such as soy beans is comparatively light summer cropping, and possibly lighter soil south of the Yellow River has necessitated this arrangement. The region south of the Yellow River represents for the most part sandy deposits from the Yellow River in its history of changing its course and breaking the dikes which confine it. The deposits of the Peiho in the North are generally of heavier soil." (Nyhus, pp. 15–18.)

THE LOESS HIGHLANDS

The Loess Highlands lie between the North China Plain and the deserts of Central Asia, and have characteristics that are intermediate. Most of the region is semi-arid, with a rainfall of from ten to fifteen inches.

The distinctive feature of the landscape is the thick mantle of loess, a fine silt-dust that has been blown outward from the Gobi and Ordos Deserts and sprinkled over the country as though by a giant flour sifter. The loess covers all of the country, except the highest mountains, between the Great Wall and Tsinling Mountains. The thickness of the loess has often been exaggerated, for it probably nowhere averages over three hundred feet. The total volume is estimated at 2,852 cubic miles.

The steep mountain slopes and the dissected loess topography cause human activity to be concentrated in the larger valley bottoms. The loess hills are often terraced, but on account of the scarcity of water they are not irrigated, and hillside crops mature only in the

FIGURE 14.—Barren hills surround the dry fields of the North China Plain, with a veneer of wind-blown loess mantling the lower slopes. This photograph from western Hopei (Chihli) illustrates the characteristic vertical cleavage of the loess. (Bailey Willis, Courtesy Carnegie Institute.)

more favorable years. The only areas of green are the thread-like strips along the streams. While most of the region is hilly, there are several plains of considerable extent, notably around Taiyuan and Sian, where conditions resemble the North China Plain. Cultivated land amounts to only 17 per cent of the entire area, in contrast to 66 per cent in the North China Plain.

Nyhus divides the Loess Highlands into three areas, Northern Shansi and Shensi, the Kansu Highlands, and the Winter Wheat and Summer Fallow region in the south. Writing of the first of these, he says:

"Under these conditions millet of different varieties is the leading crop. A number of localities indicate that fully 60 per cent of the total farming land is so planted. Forty to 50 per cent seems to be 'Ku tzu' or Italian millets (non-glutinous), and 10 to 20 per cent 'Mi tzu' or Broomcorn millets (glutinous, Panicum Miliaceum). Kaoliang varies from only a few per cent in some localities to 30 per cent on the Taiyuan Plain, where moisture conditions are better. Ten per cent of beans are general and are mostly black soy beans. Oats may be as much as 25 per cent, depending on the mountainous nature or altitude of the locality. In some districts oat flour can often be bought cheaper than millet. Spring wheat, sown early, occurs in some localities. Irish potatoes, apparently an introduction from the West since they are called 'Foreign' potatoes, are reported from many localities in this region. In the northwestern corner of Shansi, peas assume an important place, possibly indicative also of Northern Shensi.

"In the north along the Peking Suiyuan Railway, there are localities having irrigation water where poppies for opium are grown to quite an extent, but for the region as a whole the poppy acreage probably represents only a small percentage. There is a certain amount of irrigation by river water and wells on the Taiyuan Plain. A resident at Taiku estimated that there is a crop of winter wheat and double cropping on 25 per cent of the

FIGURE 15.—High meadows in Shansi, in the Loess Highlands region, provide grazing grounds for the work cattle of the cultivated valleys. (W. C. Lowdermilk, Courtesy University of Nanking.)

cropped land. With this modification the crops are much the same as in the drier loess hills to the North. With more favorable moisture conditions more kaoliang is grown but, nevertheless, millets—late planted and shorter seasoned—exceed the kaoliang acreage. The two cereals occupy about 70 per cent of the land in the summer. Traveling south from the Taiyuan Plain in 1929, some of the valleys seemed to be exclusively millet, rising step by step by natural loess terraces into the sides of the barren mountains. The southern boundary of the region is determined by the establishment of winter wheat and winter cropping as a major practice, more or less fallowing during the summer months, and, in general, by a longer growing season" (pp. 19–21).

With higher altitudes and lower temperatures in Kansu, Nyhus describes conditions there as follows:

"Here there is a substantial acreage of spring wheat, which, together with peas, makes up the early or summer harvest as distinguished from the autumn harvest consisting chiefly of millets. Tsingning, on the border between the spring wheat and winter wheat regions, relates that of the wheat grown 70 per cent is spring and 30 per cent is winter wheat. Wheat and peas together occupy as much as 20 to 40 per cent of the crop land. The late crops are, however, the more dependable sources of the food supply with millets, similarly as in Northern Shansi, absorbing half of the crop area over a large part of the region. Oats are general to the extent of 10 to 20 per cent and smaller percentages of flax" (p. 22).

In the southern part of the Loess Highlands, winter wheat and summer fallow appear to be the rule.

THE MOUNTAINS OF SHANTUNG, LIAOTUNG, AND JEHOL

The region includes three areas grouped around the Gulf of Chihli. These areas form a geologic, as well as a geographic, unit, for they are largely made up of hard ancient rocks that have been eroded into bare, steep-sided mountains. Overlying these older formations are here and there softer coal-bearing formations that form islands of more gentle relief.

Although this is one of the smaller of the geographic regions, its position next to the sea and its proximity to two of the most important agricultural plains give it an increased importance.

Coal and iron are both mined on a large scale, but agriculture is still the dominant occupation, with 20 per cent of the land under cultivation. Wheat, millet, kaoliang, and beans are the chief field crops. Pongee silk is obtained from silkworms fed on oak leaves.

FIGURE 16.—A rich yield of millet in Shantung, where this cereal forms one of the principal articles of diet. (Courtesy United States Department of Commerce, Shanghai.)

THE MANCHURIAN PLAIN

The central portion of Manchuria is a rolling grassland drained by the Liao and the Sungari, and surrounded on all sides by mountains except for a limited opening to the sea on the south. The rainfall is slightly higher than in the North China Plain, and comes earlier, while lower temperatures reduce evapo-

ration and make harvests more reliable.

The Manchurian Plain is a pioneer land of rapidly expanding agriculture. Although the region south of Mukden has been occupied by Chinese for many years, a great migration into northern Manchuria has been in progress since 1923. This movement of farmers from old China, south of the Great Wall, has been due to the attraction of free or cheap land in the pioneer northland and to the devastation of the North China Plain by civil war, bandits, and famine. The extent to which these colonists have moved northward because of the pull of the pioneer urge as compared to the push of circumstances in their old homes is an important question, for it has a bearing on the future of this new land.

FIGURE 17.—Soy bean cakes are formed in hydraulic presses that separate the oil and leave the residue; they are high in protein and desirable for cattle feed or, especially, as a fertilizer for mulberry. These Manchurian bean cakes at Dairen, consigned to Japan, may re-appear as silk hosiery in America. (Courtesy Dollar Steamship Co.)

Kaoliang, millet, and wheat are raised as elsewhere in the North, but it is the soy bean that has been responsible for the marked prosperity of the region. The world-wide sale of beans, bean cake, and bean oil has made this the only region in China where exports exceed imports. The prosperity and the progressiveness of Manchuria are shown in the fact that it has a mileage of railways almost equal to that of all China south of the Great Wall.

"Very cold winters eliminate the possibility of two crops per year and confine agriculture to spring planted crops. The region, however, is extremely productive. For three summers the writer has had an opportunity to compare crops in Manchuria with crops in various parts of North China, and each year the uniformly excellent condition and outstanding superiority of Manchurian crops have been a source of wonder. Newer land and vast stretches of fertile soil is a partial explanation, but underlying the productiveness is a better distributed and more dependable rainfall than for any place in North China.

"From a cropping standpoint this entire region is remarkably uniform. In the North there is considerable spring wheat and in the South corn, but soy beans, millet and kaoliang make up the 'big three' of this region both in the North and in the South. The soils vary from rich black humus land on the Sungari Plain, the lighter colored series of the Liao Basin, sandy regions on the West and gravelly soils to the Southwest, and would permit of a wide variety of crops, but the special climatic conditions seem to considerably restrict the variety of crops which can be profitably grown. The staple crops of the region all require similar conditions, and to see the thriftiness of the soy bean fields of Manchuria is convincing proof of the adaptability of soy beans to the special climatic conditions, and explains the almost exclusive position in the world which Manchuria occupies as an exporting region for soy beans.

"In the North kaoliang occupies only 15 per cent of the crop land, but through Central Manchuria fully 25 per cent and to the South and Southwest it is the leading crop, absorbing 30 to 60 per cent of the crop land. Adjoining districts in Chihli and Jehol have a similar amount of 40 per cent. Millets, next to kaoliang in acreage, seem to have quite a uniform distribution, and take up about 17 per cent of the crop land. The leading cereals in the diet are millet and kaoliang and, in view of a population of approximately 30,000,000, the requirements are very large. There is, however, a surplus also of these

cereals for export to Chosen (Korea) and North China ports." (Nyhus, pp. 31–33.)

THE MOUNTAINS OF EASTERN MANCHURIA

This region is partially undeveloped. Agriculture has penetrated the valleys along the borders, but most of the mountains are still covered with thick forests, chiefly of coniferous forms. Lumbering and fur trapping are important industries, and the reserves of timber are the largest in China. Several railways penetrate the region, but have not yet brought much in the way of agricultural occupation. Nearly a million Koreans have come into the eastern area.

FIGURE 18.—Horses and other draft animals are numerous in the drier North, but the iron-tipped wooden plows are seldom efficient.

THE KHINGAN MOUNTAINS

This region has the shape of an inverted "L," bounding the Manchurian Plain on the north and west. The northern portion is known as the Little Khingan and is forested, while the western range, the Great Khingan, is the grassland border of the Mongolian plateau. Neither portion contains any towns of importance, nor agricultural land.

THE CENTRAL ASIATIC STEPPES AND DESERTS

Mongolia and Sinkiang, or Chinese Turkestan, contain a million square miles in which the rainfall is less than ten inches. In the true desert, vegetation is almost entirely absent; but around the margins the rainfall is sufficient for a sparse growth of grass. This bordering land is the steppe and is the home of nomadic peoples who depend upon flocks of sheep, cattle, horses, or camels for their livelihood. In addition to these wandering folk, there is a considerable population living in the oases that dot the area and serve as widely spaced stepping stones by which the caravan routes cross the desert.

Sand drifts into dunes in the Taklamakan Desert, but most of the Gobi is free from shifting sand, being, rather, a rock-floored series of basins. The winters are long and severely cold, and the short summer season is hot.

The Mongols live a simple, pastoral life in their felt-covered tents or yurts. Food, clothing, shelter, fuel, transportation, and wealth are all derived from their flocks, which feed on grass which, in turn, is dependent upon rainfall.

This arid border country outside the Great Wall has frequently been suggested as a colonization zone for people from the overcrowded portions of older China. Some settlement has already been undertaken in the more moist districts, but there is no reason to expect that the Central Asiatic steppes and deserts will ever be able to absorb any material portion of China's surplus millions. There are a few areas along Hwang Ho where irrigation may be practiced, but elsewhere the evidence is clear that the region is not safe agricultural development.

THE CENTRAL MOUNTAIN BELT

The Central Mountain Belt is made up of a series of ranges extending from Tibet almost to the Pacific. The topography is rugged in the west, where the elevations rise to three miles, but be-

comes more gentle toward the east. These mountains cut directly across central China and separate the country into two very diverse parts. Chief of the various ranges is the Tsingling.

This is a transitional region which marks the southward limit of loess, cold winters, and dry crops such as millet and

FIGURE 19.—Wheelbarrows are widely used for short hauls, especially in North China. With a burrow or a coolie pulling in front, the task of the man behind the shafts is principally to balance the towering loads. These reeds are probably destined for fence or house construction. (Courtesy Dollar Steamship Co.)

kaoliang, and the northward extent of water buffalo, rice, tea, and bamboo.

These mountains have likewise had a political significance, for they have formed a barrier to armies and rebellions. In 1860 they prevented the Taiping rebels from coming north of the Yangtze valley, and in 1875 they similarly limited the southward advance of the Mohammedan uprising in the northwest.

THE YANGTZE PLAIN

This region is largely made up of the alluvial plain of Yangtze Kiang below Ichang, although there are some areas of hills that are necessarily included. The lower part of Hwai Ho and the area around Hangchow Bay are also included. This is a land of canals, with an estimated length of over thirty thousand miles in the delta alone.

The Yangtze is the largest river in Asia and of foremost importance to China. It is navigable for ocean steamers to Hankow, 630 miles from the sea, and by smaller steamers for a thousand miles more. In some sections the banks are diked, but the flood menace is normally less than with Hwang Ho, although a particularly serious flood took place in 1931, inundating 34,000 square miles.

The region has a population density of 897 people to the square mile, the highest in all China. The Yangtze Plain is a region of intensive agriculture, with rice, silk, wheat, beans, cotton, and oil seeds as the principal crops. A large amount of hand labor is used in cultivating the soil. The rainfall exceeds forty-five inches and the growing season lasts for ten months, so that two crops per year are the rule.

The Yangtze Plain is the social, political, and economic heart of the new China. Modern factories, electric lights, telephones, and imported goods are found in all of the larger cities.

Nyhus describes conditions in the Yangtze Delta as follows:

FIGURE 20.—Rice fields must remain flooded during most of the three-months growing season. This requires frequent use of the wooden trough pumps to lift water from canals or ponds. Such pumps are operated by foot power or by water buffalo. A scene in the Yangtze delta near Shanghai. (Courtesy Mactavish and Co.)

"Winter wheat predominates but, in several districts, notably in the Tungchow cotton district where it is desirable to get the winter grain off the land as soon as possible, barley largely replaces the wheat. A small percentage of broad beans is general, with districts between Shanghai and Hangchow growing fully 25 per cent. Rape seed has a spotted distribution,—a small per cent in most localities and a large per cent in others. Canal water for irrigating rice is general in this delta district and rice transplanting awaits, in order, the bean, rape seed, barley, and wheat harvests in May or early June. Here, as elsewhere in China, small beds of seedlings provide the young plants which are transplanted or set out by hand. Cotton is frequently sown broadcast and hoed in before the wheat is harvested.

"There is a non-irrigated district north of the Yangtze represented by Jukao which reports only 5 per cent rice, but with the additional exceptions of cotton or mulberry localities the appearance in summer of many parts of this region gives the impression of rice almost exclusively, and over much of the region probably more than 75 per cent of the cropped land is in rice. In Eastern Chekiang the tendency toward two crops of rice appears in a modified form in the interplanting in alternate rows of early and late rice. The early rice is taken off in early July without interfering seriously with the seasonal growth of the late variety which comes to maturity in October.

"Districts in Kiangsu and Chekiang comprise a leading silk-producing region in China, and mulberry trees, the leaves of which are fed to the silk worms in sericulture, occupy a considerable area in some localities. Wusih reports 50 per cent of the land in mulberry trees. There is 10 to 15 per cent of soy beans in many localities. Sweet potatoes, taro, water chestnuts, corn and peanuts occupy small percentages in different localities. Rice and cotton harvests occur in October, and by November the country is again green with the stands of wheat and barley. Near Shanghai the broad beans are planted in November before the cotton plants have been removed, but sometime during the fall and winter the cotton stalks are pulled out by the roots, tied into bundles and carried to the farm, village or market to be used for fuel.

"Of foremost importance in maintaining fertility in this and other intensive and productive regions of Central and South China is the careful collection and use of night soil from a densely populated region. The vats or cisterns containing night soil or composting material are to be seen everywhere as one walks through the countryside. In canal districts the fertile sediment in the canals is frequently and regularly removed and spread over the adjoining fields. Farm yard refuse, rice chaff, and all forms of vegetable materials are carefully composted. In many fields a variety of clover is seeded in the fall and plowed under in May and June. To some extent grasses and weeds in waste places are cut and, in order to rot quickly, are worked or pushed with the feet into the soft mud of paddy fields. Commercial fertilizers in the form of bean cake or mineral mixtures are only sparingly used." (Nyhus, pp. 36–38.)

FIGURE 21.—Even the ponds and canals yield their harvest. This is an underwater scythe that cuts aquatic plants from the bottom of the pond so that they may be spread upon the fields for fertilizer, as here shown near Nanking, in the Yangtze Plain. (Courtesy The Photo Bureau.)

THE RED BASIN OF SZECHWAN

The Red Basin forms one of the most enthusiastically praised regions in China. It it said that everything that can be grown anywhere in China may be produced here, for the climate is favorable, the soil productive, and the people energetic.

This basin lies in the far west and is surrounded on all sides by high and rugged mountains, so that access is difficult. The only entry of importance is through the gorges of the Yangtze, which lie in the Central Mountain Belt.

FIGURE 22.—Probably no section of China has such an extent of slope utilization as the Red Basin of Szechwan. This is a May landscape south of Chungking. (Courtesy China International Famine Relief Commission.)

Specially constructed river steamers now regularly navigate the rapids, but it was formerly necessary to travel on native junks that were towed up the river by long lines of trackers. Despite its isolation from the outside world, this region has a population of 43,860,118, with a density of 581 per square mile.

Most of the Red Basin is made up of hills of red sandstone that are more extensively terraced than in any other section. There is also a remarkably fertile plain around the city of Changtu.

Transportation is largely dependent upon man power to pull junks, push wheelbarrows, carry sedan chairs or transport loads.

Agricultural conditions in all of West China are grouped together and described by Nyhus in the following paragraphs:

"The western district consists of mountainous country and extends from Southern Shensi to the French Indo-China border. The Red Basin of Szechwan, which includes most of the eastern half of Szechwan and the northern part of Kweichow, consists of low hills, terraced to the very top and admitting of land usage to a far greater degree than elsewhere in the region. But surrounding this geographical formation and throughout the region to the south are high mountains which confine agriculture to valleys, narrow plains and foothills. On the north the high Tapa Range of mountains separates the Han Valley in Southern Shensi from Northern Szechwan. There is much to indicate similar conditions in the two places, but the extent of the winter wheat and cotton acreage in the upper region of the Han River in Shensi has prompted the writer to include the entire Han Valley with the Central China district. On the west, in the mountains beyond Min River, is tribes' country where travelers tell of Chinese farmers having crowded the tribes people off the rice lands in the valleys, but where corn on the mountainsides is a leading item of food grain. Still farther west, on the Tibetan highlands, barley is the leading cereal. Mountainous country which begins in Western Hunan becomes more marked in Kweichow, and agriculture seems especially to be in mountain valleys and on the sides of mountains. In Yunnan Province, likewise mountainous, a uniformly high altitude is maintained, and one of the leading agricultural districts consists of a plain at Yunnanfu at an elevation of 6,500 feet. To the extreme south in Yunnan, plains and valleys, at high altitudes drop to low levels, and, in the course of one day's travel on a slow train, conditions change from very temperate to a distinctly tropical environment. From valleys of broad beans, or dry idle fields awaiting rains, to tropical forests with their dense undergrowths and vines, and rice fully one foot high already in April, are some of the very noticeable changes as one drops from the high altitudes in Yunnan to low altitudes near the French Indo-China border." (Nyhus, p. 43.)

"A certain diversity of winter crops and rice and corn as summer crops characterize this agricultural region. In Szechwan the

lowest terraces or fields in which water is stored or collected in the spring do not produce a winter crop, but are used for rice exclusively. In marked contrast to the Central Region, winter wheat in Szechwan probably does not occupy more than 20 to 25 per cent of the land, and in Kweichow and Yunnan much less. It holds a minor place compared to poppies for opium in Kweichow, and it is outranked by both broad beans and opium in Yunnan. This region is recognized as the main source of opium in China. The acreage in Szechwan does not appear large in the localities from which reports have been received, but travelers tell of long overland trips where one out of every seven fields was in poppies. In Kweichow the reports range from 20 to 80 per cent.

"Rape seed from which the oil is extracted for cooking purposes holds an important place in Szechwan and Eastern Hunan, but the acreage is small in Kweichow and Yunnan. Throughout the Yangtze Valley there occurs

FIGURE 23.—Almost every farm courtyard has a stone mill for grinding grains or, perhaps, dried beans or peppers. Where larger, the mill may be turned by an animal. (Courtesy Mactavish and Co.)

a spotted distribution of broad beans, but in Szechwan and Yunnan they are grown in practically every locality. They occupy 20 to 50 per cent of the land in many places in Yunnan. The writer has seen flats and valleys in Yunnan where it seems to be the only crop grown during the winter months, and reports from several missionaries indicate a similar situation. In Yunnan the harvests of winter crops are pretty well completed in April, and in Szechwan in May. The wood oil trees on the hills and mountains in Szechwan and Hupeh are the source of a large export trade in wood oil.

"In general, rice is grown during the summer to the extent that rainfall, irrigation facilities or character of the land will permit. In Szechwan these limitations are considerable, and there is quite a diversity of farming conditions and summer crops. There are occasional plains without irrigation such as at Tsinning, where there is no rice whatsoever and where kaoliang, corn, hemp, peanuts and cotton constitute the summer production. On the irrigated Chengtu Plain, however, fully 80 per cent is in rice. More representative of the province because of the prevailing hilly country are much smaller percentages of rice, 25 to 40 per cent, consisting of the valley lands and lower terraces where irrigation water can be secured by various means." (Nyhus, p. 47.)

THE SOUTH YANGTZE HILLS

All of China south of the Yangtze is distinctly hilly or mountainous, and forms a super-region known as the South China Highlands. Level land is strictly limited, and there are no broad plains such as those that characterize the North. The South Yangtze Hills include that part of the region tributary to the Yangtze Plain, chiefly in Hunan and Kiangsi.

Cultivation is restricted to the valley floors and the lower slopes of the hills. Rice is the dominant crop, but only limited areas of the hills are terraced. There is normally a surplus for export to the industrial districts along the Yangtze. Tea forms an important cash crop, and is grown more extensively here than anywhere else in China. Land forms restrict farming, but climate favors agriculture, so that there is a dense concentration of people along the river valleys.

THE SOUTHEASTERN COAST

The Southeastern Coast consists of a rocky and irregular shore line backed by picturesque mountains, roughly parallel to the sea, through which swift rivers have cut narrow canyons. Each of these streams has a delta and an im-

FIGURE 24.—Contrast the verdant hillsides of Fukien with the barren hills of Hopei, shown in Figure 14. Contour terraces wind about the lower slopes wherever soil and available water permit. Water buffalo are the farm animals of the south. (Courtesy American Museum of Natural History.)

portant city at its mouth, and these cities and tributary rivers dominate the economic life of the area. Travel is by boat along the rivers, or by sea from one city to another, rather than overland. Fukien is the principal province, with portions of Chekiang and Kwangtung ranking second.

Fishing is an important industry along the coastal fringe. The building of junks is aided by supplies of timber that are brought down from the mountains. The maritime interests of the region have led the people to migrate to the South Seas in large numbers, and the stream of remittances sent back to relatives by these adventurers plays an important part in maintaining the dense population.

This is the typhoon region, with the possibility of severe storms from July to September.

THE HILLS OF LIANGKWANG

The provinces of Kwangtung and Kwangsi form the tropical region of China, with abundant rainfall and a year-round growing season. The year may be divided into three seasons, a long, hot, humid summer from April to October, a short, dry winter until February, and two months of transition with fog and muggy weather. The rainfall exceeds sixty inches. The perpetual greenness is in sharp contrast to the brownness of the North during so much of the year.

Agriculture is carried on under intensive conditions and involves excessive amounts of hand labor. Draft animals are less important than farther north, for the demand for human food is such that there is no land available for forage crops. The water buffalo is the principal farm animal. Two crops of rice per year are the rule, and a third crop of vegetables may also be raised. Other products are sugar cane, tobacco, palm leaves for fans, excellent oranges and other fruits, and mulberry for silk.

On account of the large amount of hill land unsuited for occupation, the population density of the region as a whole is not particularly high. The real crowding may be seen in that the farm land per capita is but 0.18 acres, so that

FIGURE 25.—Sweet potatoes are grown throughout China, being, in some areas, the principal crop. These narrow terraces in Fukien permit the vines to grow down the slope in order to receive maximum sunlight. (Courtesy The Photo Bureau.)

there is the amazing total of 3,495 people to each square mile of cultivated land. High standards of living are impossible under such conditions.

The people of this region, particularly those from the Canton Delta, are among the most progressive in China. Large numbers have gone overseas to the Malay Peninsula and the East Indies. The energy and business ability of the people appear to be due to qualities of race rather than to the environment, which is less stimulating than that of the North.

"The Canton Delta or the delta of the West River, supplied with innumerable canals and streams, is one of the most intensive farming districts in China. The first rice crop is set out in March and harvested in July, and the second crop transplanted in July is, in turn, harvested in October and November. The mulberry and silk cocoon industry is a very important item of farm production. Considerable bean cake and mineral fertilizers, mostly ammonium sulphate, are used in the delta district. Transportation costs quickly restrict the use of commercial fertilizers in many other parts of China, but here a very intensive farming district is reached by cheap ocean and canal transportation, and it represents the largest single district as a market for commercial fertilizers in China. Possibly the rainfall in the Canton Delta is more dependable than in any other region in China." (Nyhus, pp. 59–61.)

THE SOUTHWESTERN TABLELAND

This region is a dissected plateau, cut by deep canyons and crossed by high mountains. It lies largely in Yunnan and Kweichow. The average elevation is above a mile, so that although it lies near the tropics it has a delightful, temperate climate. There are several broad plains, and these areas, together with the valley bottoms, are intensively tilled. Rice is the dominant summer crop, and the opium poppy is conspicuous during the winter.

The southwestern tableland is an anthropological museum. Only about half of the people are Chinese, and the remainder comprise a great variety of primitive tribes. In most cases, the standard of living is low. Difficulties of transportation will doubtless keep this a backward region for some time to come.

FIGURE 26.—Flooded rice fields on the mile-high plateau near the city of Yunnanfu in the Southwest Table-land region. Intensive cultivation is necessary to provide for the dense populations that characterize South China. (Courtesy China International Famine Relief Commission.)

The agricultural characteristics of this area as described by Nyhus have already been quoted in connection with the Red Basin. The following information applies particularly to the southwestern tableland:

"Summer crops in Kweichow seem to consist almost exclusively of rice and corn.

Much of the rice acreage there depends entirely on rainfall, and rice is set out on as much land as will hold water. The valleys grow rice, and the mountainsides mostly corn. In localities this may be more corn land than paddy fields, but the returns as a whole show somewhat more rice than corn. There is a notable absence of other crops. Beans are interplanted with corn in some localities, and sweet potatoes, peanuts, buckwheat and tobacco are mentioned.

"In the extreme western part of Kweichow, among mountains, the cropping system is sharply altered by changes in the altitude. Two localities in the mountains report tall sown oats on 25 and 46 per cent of the farm land with chiefly corn interplanted with beans occupying the balance of the land during the summer. There are small percentages of buckwheat, and foreign potatoes occupy as much as 10 per cent of the land in both localities. The comments from Kiehkow describe changes from opium and rice at low levels to only buckwheat and foreign potatoes at high altitudes.

"In Yunnan summer cropping is similar to that in Kweichow, with the exception that more ample rainfall seems to enable a larger rice acreage and a corresponding reduction in the corn acreage. Here, also, plains and fields are in rice, with corn on the hills and mountainsides. The reports reflect high percentages of rice on some of the more developed plains and valleys, but residents state that among the tribes people, pushed off into the endless hills and mountains of the province, corn is cultivated almost exclusively, and with very primitive tools and equipment and much hard labor. Plots of buckwheat on knolls or mountainsides form a considerable acreage, and foreign potatoes are quite widely grown and of importance in some localities." (Nyhus, pp. 48–49.)

THE TIBETAN BORDERLAND

The plateau of Tibet is the highest area of land on the face of the earth. On the side next to China Proper, this lofty highland is seamed with deep gorges in the center and south, and marked by inclosed basins toward the north. Despite the great altitude and the consequent cold, conditions of life resemble those in the Central Asiatic steppes and deserts. Many of the people are nomads, who move up or down the slopes in search of pasture for their flocks of sheep or yak, according to the season.

The characteristic beast of burden is the yak, from whose hair are made the black tents of the nomads. Tibet is divided politically into Nearer and Farther Tibet. China exercises an uncertain jurisdiction over the former, but the latter portion, which includes Lhasa, is practically autonomous.

THE BAY OIL INDUSTRY OF ST. JOHN

Earl Shaw

ALL geographers have read about the triangular trade among the three Virgin Islands of the United States—how the bay oil of St. John and the alcohol of St. Croix meet at St. Thomas to be manufactured into bay rum. Probably not every one, however, is familiar with the details of each island's share in the commerce and it is the purpose of this article to indicate the part played by St. John.

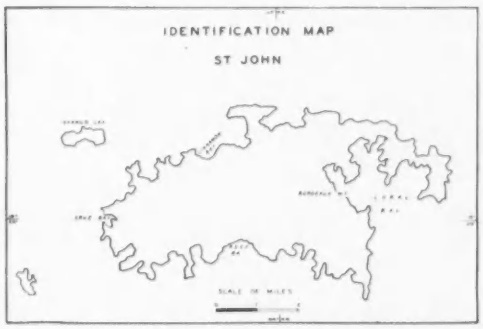

FIGURE 1.—Two major periods of submergence in Quaternary time account for the many indentations of St. John's shore line. In early days pirates and buccaneers used the bays and inlets as bases for preying upon Spanish trade. After settlement the sugar planters took advantage of the irregular coastline and delivered their produce and supplies by boat. This method was easier than carriage of goods over the rugged mountain trails that are common on the island. To-day some of the bay leaves are delivered to the still in boats because easily accessible harbors encourage water transport.

St. John (Figure 1), the smallest of the Virgins, both in area (approximately 20 square miles) and in population (765 with only 4 white), lies near the northeast corner of the Caribbean Sea. In the early days pirates and buccaneers used the inlets and bays of its submerged shoreline as bases for preying on Spanish trade. Then followed its colonization and development by the Danes, who converted it into a sugar-producing land in spite of the maturely dissected upland comprising nearly the whole of its area (Figure 2). Slaves were cheap, sugar prices were high, and hand-cultivated cane milled by animal and wind power yielded profit in spite of the rugged topography. But beet sugar, East Indian cane competition, and free labor ended the reign of sugar in St. John, and for several decades the island's economy has depended on cattle raising, fishing, sustenance farming, and bay oil manufacture.

Just when an export bay oil industry began is not known, but wide local use of bay leaves started in early colonial days. The negro slaves employed in the cane fields mixed bay leaf juice and water to rub on their tired muscles after the day's work. Later they changed the formula by substituting rum in place of water and found that it improved the product considerably. The first commercial manufacture of bay rum in the neighboring isle of St. Thomas began about the time of the United States Civil War, and it is likely that traffic with St. John in bay oil began soon after.

The bay tree, *Pimenta acris*, a member of the myrtle family, is indigenous

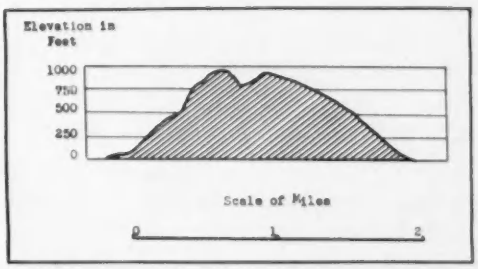

FIGURE 2.—This north northwest-south southeast topographic profile from Cinnamon Bay to Reef Bay indicates the maturely dissected upland of St. John. The vertical scale is exaggerated approximately 3 to 1.

to St. John (Figure 3). Although it is found in several places on the island, three-fourths of the growth occurs on the upper slopes of Bordeaux Mountain, just west of Coral Bay (Bordeaux Mountain, 1277 feet high, is the highest point on the island). Unlike the occurrence of many valuable trees in the tropic forests, the bay trees here form a more or less consistent stand and probably the largest single natural bay development of any place in the West Indies. Just what feature of the physical environment accounts for the luxurious growth never has been determined definitely. Some ascribe it to a peculiar adaptability of the soil, yet there is no general acceptance of this belief.

FIGURE 3.—One of the few bay groves that has been cleared of underbrush.

Pimenta acris looks a little like a pear tree, has an average height of twenty to thirty feet, and never reaches large dimensions. Its glossy, leathery evergreen leaves contain the bay oil in their minute cells. The trees blossom early in July and, after they drop their seeds during the months of August and September, a more luxurious growth of foliage develops. Although the tree does not reach maturity until about ten years of age, leaves may be picked at an age of three to five years, and with proper care the plant may yield for three or four decades.

The bay oil industry is not a plantation development. No attempt is made to plant the trees, but birds, eating the bay berries, and the wind, are the scattering agents for the seeds. Seedlings start, trees develop, and if the land owner wishes to encourage a favorable leaf growth, he clears the brush around the young trees (Figure 3). Leaves are usually picked on the basis of a two-year cycle. There are more than enough to supply oil for the present market, and the picking is so apportioned that the harvest may continue at any time, yet no tree is stripped oftener than in alternate years. Rainfall is moderate and variable like many tropical regions, yet its major controls, convection and hurricane influences, bring about ample precipitation for a heavy leaf growth at biennial intervals.

At harvest time the picker strips twigs as well as leaves from the tree. Instead of harming it, the breaking of the smaller branches seems to encourage more growth, for several twigs sprout from the break made by the removal of a single branch. On an average one man can pick about two hundred-weight of leaves per day. Often the pickers work in pairs, one man climbing the tree and breaking or slashing off leaves and twigs while the worker on the ground picks them up and stuffs them in burlap sacks holding 75 to 100 pounds each. Sometimes children help with the picking because they can climb the small trees better than an adult. After the leaves are sacked, they are loaded on donkeys, usually one bag on either side, and a small pack train of these little animals, so well fitted for burden bearers on the rocky trails around Bordeaux Mountain (there are no roads in St. John), takes them down grade to the still at Coral Bay (Figure 4). Here the sacks are unloaded and oil is distilled within a short time, as

fresh picked leaves furnish a better product than stale ones. The still owner sometimes buys leaves from other farmers to supplement the supply grown on his own land. Many of these are brought in by boat, for the small size of the island and the numerous bays and inlets make boat transport easier than animal carriage over rugged trails. Several hundred-weight of leaves go into the still at a cooking. The steam and pungent oil are condensed in a metal "worm" enclosed in a tank of water and then separated in another section of the still. Approximately one hundred fifty pounds of leaves are used in making one quart of oil.

Native families perform the labor in the bay oil industry. They cut the brush between the mature trees (Figure 3), clear the land where seedlings are developing, and pick the leaves at harvest. The land owner provides them with a plot of ground on which they build a rude hut (Figure 5), and where they raise such provision crops as tanias, sweet potatoes, corn, okra, cassava, papayas and bananas. They supplement these activities with fishing, burning charcoal, and gathering fruits and nuts from the forest, which covers eighty per cent of the island.

Not many workers are needed. Although there are hundreds of acres of mature trees, most of the bay tree region is uncared for and is growing up with thick underbrush. There is little market for the product and only one of the four stills on the island is operating —this one intermittently. For the last few years annual production of oil has averaged about four hundred gallons, which at present prices would yield approximately four thousand dollars a year. Unlike St. Thomas' bay rum manufacture, which has expanded from a production of 10,000 gallons in 1910

FIGURE 4.—The E. W. Marsh bay oil still, the only one now operating in St. John.

to a production of 138,065 gallons in 1931, St. John's bay oil industry shows little evidence of increase. There are several causes for this lack of progress.

First, bay oil forms a very small fraction of bay rum which is made up almost entirely of alcohol, quinine, and bay oil. Second, although *Pimenta acris* grows naturally without intermixture with closely related species bearing leaves of poorer quality, the harvesting and distilling are performed in a careless manner and the resultant product lacks a quality that careful practice would impart. Third, the man who practically controls the industry is a wealthy negro well satisfied with his present income from the business. He does not care to change over to processes and equipment that might expand the market for his product. Finally, other islands of the West Indies, Puerto Rico especially, are expanding their bay oil production and are providing keen competition.

Yet there are possibilities for growth in St. John's well-known industry. The thousands of trees throughout the island have a leaf base superior in quality to that of many other West Indian islands. It is likely that with an improvement in harvesting and distilling methods a standardized product could be obtained that would significantly increase demand. The Chemical and

FIGURE 5.—The home of one of the laborers in the Bordeaux Mountain bay tree region of St. John. The harbor of Coral Bay lies in the background.

Technological Research Section of the United States Bureau of Chemistry and Soils is seeking new uses for the oil and may discover possibilities for new markets. Some optimists believe that an adherence to standardization and a continuation of research will, in time, create a large native industry. They even suggest that selective propagation and forest planting might lead to important developments on the other Virgins, St. Thomas and St. Croix.

The writer is inclined to be skeptical of this optimistic outlook. He believes that future growth will be slow and insignificant. For, in addition to the drawbacks previously indicated, there is always the hurricane hazard which deters a spirit of progress, and which, not many years ago (1916), destroyed practically all the bay trees of St. John.

LOCATION FACTOR IN THE CHOICE OF FREE PORT SITES

S. Axel Anderson

IN THE past, hearings have been held under the auspices of Congressional committees and the U. S. Tariff Commission for the purpose of ascertaining whether or not any material advantages may be expected from free ports if established in this country. It seems to the present writer that before any worth-while forecasting can be made with regard to the benefits that might accrue from free ports in American ports of entry, the most important factor to be considered is that of the geographical location of the proposed sites. While theoretically any port possessing a good harbor may be considered a potential free port, few ports are so situated with regard to foreign countries that they can be reasonably expected to become serviceable free zone centers.

The Free Port Defined

A free port or a free zone is an enclosed area, exempt from the customs laws that affect the surrounding territory. The free port area is usually isolated and without resident population. It has facilities for discharging and loading, for supplying fuel and ships' stores, for storing goods and for reshipping them by land and water. Within this area goods may be stored, assorted, repacked, manufactured and later reexported without payment of duties and without intervention of customs officials. If the goods are shipped to consumers in the country in which the free area is located, they are, naturally, subjected to the prevailing customs duties. The free port is on a par with the regions adjacent to it in respect to the laws pertaining to police, public health, vessel inspection, postal service, labor conditions, immigration—in fact, everything except the customs. The usual conception of a free zone is that of an area connected with a deep water port. This is not necessarily the case, as a free zone for the assembling of foreign and domestic goods destined for export may also be established in an interior location of strategic importance.

The Free Port and Its Location

The free port is essentially an institution by means of which man has endeavored to remove from a port of excellent geographical location for the pursuance of foreign trade certain hindrances placed upon it by high tariffs and cumbersome customs regulations. In many ports the free zones have not only neutralized the adverse conditions emanating from political considerations, but by offering excellent facilities and services to consignment and transit trade, they have also aided very materially in making these ports still more important emporia for international trade. While the success of a free port, no doubt, must be ascribed to several, perhaps interacting, forces, the most important single factor seems to be that of geographical location. Experiences abroad have shown that a deep harbor and an excellent port lay-out are not sufficient to insure the success of the undertaking. In order that the maximum service may be obtained, the free port must lie adjacent to a hinterland comprising nations that are sufficiently advanced so as to make an extensive

foreign trade essential to their economic life. From the point of view of commerce and transportation, the most outstanding characteristic of the hinterland of Hamburg and Bremen is its very extensive system of canals and navigable rivers. In addition, there is the close proximity of a relatively large number of independent political units. As a result of these factors, cargoes that are destined for points in the interior must be reloaded from the ocean going vessels on which they have arrived into the smaller crafts that ply on the inland waterways of north-central Europe as well as on the Baltic.

The many indentations in the shore line of the Baltic create a similar situation with regard to the free ports of Denmark and Sweden. The long coast line with its large number of natural harbors has brought into existence many relatively small ports and trading centers, each one having a rather limited hinterland to supply or to tap. Even if the harbor facilities in these smaller ports are adequate for the larger vessels, few of the ports are in a position to take, or to supply, as the case may be, goods in sufficient quantities to make it worth while for larger ships to make regular calls. Such conditions necessitate the breaking up of larger cargoes, and the reloading, in spite of the costs that it entails, becomes economically sound. Obversely, there is also need for points for the assemblage of goods destined for overseas markets, which need the free ports have been called upon to fill. The geographical lay-out of northwestern Europe thus gives to that region a rather singular position, which has contributed very largely to the growth of the free ports. While the ordinary transit trade may be carried on perhaps almost equally well under bond in the traditional customs port, the more lucrative consignment trade is pursued most advantageously under the conditions that the free port affords.

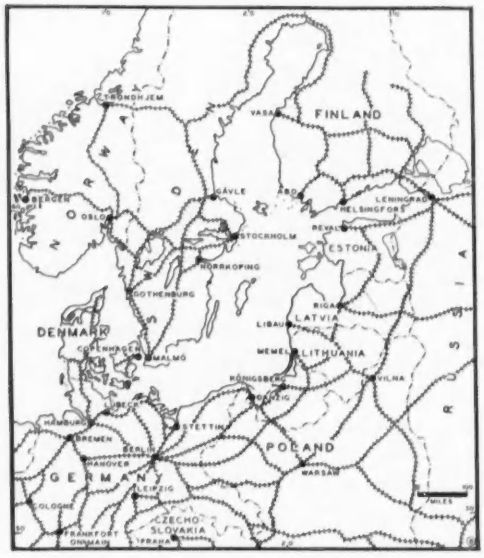

FIGURE 1.—Any one of the free ports indicated on the above map may be called upon to serve ten or more different countries. The proximity of a large number of independent political units enhances the usefulness of a free port. A similar set-up in the United States with regard to any one of her ports would necessarily call for the inclusion of Canada, Mexico, the West Indies, and the countries of Central and South America. Although the territory that could be served by American free ports is very extensive, the relatively low per capita foreign trade of most of the countries concerned and the great distances involved might tend to make free ports in this country somewhat less useful than they have been in Europe. On the other hand, it would be incorrect to say that these differences are so great that virtually no advantages may be expected from free zones, if established, in American ports of entry.

THE FREE PORT AND FOREIGN TRADE

The primary purpose of a free port is to facilitate consignment and transshipment trade, which invariably has been a very lucrative business. The early cities of Carthage, Venice, and the Hansa towns are illustrative examples of this fact. In later times other transshipping points have secured for themselves great wealth and power. Such were Lisbon and Amsterdam, and in more recent times London, Hamburg,

and Bremen. All of these have received their strength and importance from the distributive and transport trade, and from the banking business, which, as a rule, accompanies consignment and transshipment activities.

After Cromwell's Navigation Act of 1651, London received much of the transshipping business that formerly had been conducted by the North Sea ports. It also became the banking center of Europe and, thereby, of the world. From distant parts, notably the colonies, fleets of large ships brought commodities to London, which were then reshipped in smaller vessels to ports on the North Sea or on the Baltic. The city grew rich on this trade and enlarged its operations more and more until it became the chief consignment market of the world. London's great advantages have been its facilities for the free movement of cargo and also, as indirect results of these, its efficient banking houses and excellent shipping services.

While New York, New Orleans and San Francisco, to mention but a few American ports, also have achieved great importance in international commerce, their chief business has not been consignment trade, or even transit trade, but primarily direct export and import trade. Other factors than facilities for the free movement of cargoes have been responsible for their development. In New York the natural conditions favoring the construction of a large number of excellent piers, the extensive and industrially important hinterland and the very adequate means of inland transportation, notably the railroads and, at least during one period of the development, the New York State Barge Canal, greatly influenced the growth of the port. With regard to the other American ports mentioned above, the factor of location and the character of the hinterland have also exerted a preponderant influence upon their development.

It has been pointed out by merchants and others interested in foreign trade that if the direct import and export trade in American ports could be augmented by more transit trade, and especially by an important consignment trade of which there is very little at the present time, the result would be a great national gain. It has further been adduced that free zones in American ports of entry would constitute one of the most effective means by which to secure more transit trade and consignment trade. In the course of the American controversy attention has been called to the aid to foreign trade and shipping that European free ports have afforded their respective cities and nations. But an unqualified application of European experiences to American conditions might not be entirely justified. Under a system of protection like that of the United States, consignment trade, as well as other foreign trade, unquestionably is pursued most effectively through the free ports, but the mere establishment of free zones would not necessarily result in increased foreign trade. In any serious consideration of the problem attention must be given to the geographical location of the contemplated sites with regard to the wealth of the hinterland, the number of adjacent countries, and their strength as trading nations.

A FEW OF THE IMPORTANT FREE PORTS

As early as 1904 there were thirteen duty free areas in Europe, nine of which being within the bounds of Germany. The others were Trieste and Fiume in Austria-Hungary, Copenhagen in Denmark, and Salina in Rumania. The number of active free ports is now about thirty. In the following discussion an attempt is made to describe the develop-

ment, the physical lay-out and the administration of a few of the more important free ports in existence, all of which are located in northwestern Europe.

HAMBURG

For years Hamburg and Bremen were the most conspicuous examples of free ports, and Hamburg, the larger of the two, became the model for later establishments of this kind. However, the developments that led up to the establishment of free areas at Hamburg were different from those that preceded the establishment of free areas in conjunction with other ports. The reason for this was the singular political position that these cities occupied at the outset. They constituted independent federal units within the German Empire. The city of Hamburg was founded in 871 and was one of the Hanseatic towns. When the German Empire was completed in 1871, although the city became one of the twenty-six federal states, its affiliations with the Empire were not very close. In the formation of the *Zollverein*, Bismarck had much trouble with the independent burghers of Hamburg. For years they fought every attempt by the Chancellor to include their city in the *Zollverein*. Finally, in 1882, an agreement was reached by which the city lined up on a par with the other states of the Federation. In this agreement provisions were also made for creating the free port of Hamburg, which was opened in 1888. Certain inclosed zones of the harbor were set aside and designated to remain a duty-free area in a position similar to the one held by the entire city up to this time. The rest of the Free City of Hamburg became a part of the *Zollverein*. As an inducement the Empire contributed 40,000,000 marks toward the construction of the free port, while approximately 150,000,000 marks were furnished by the city itself.

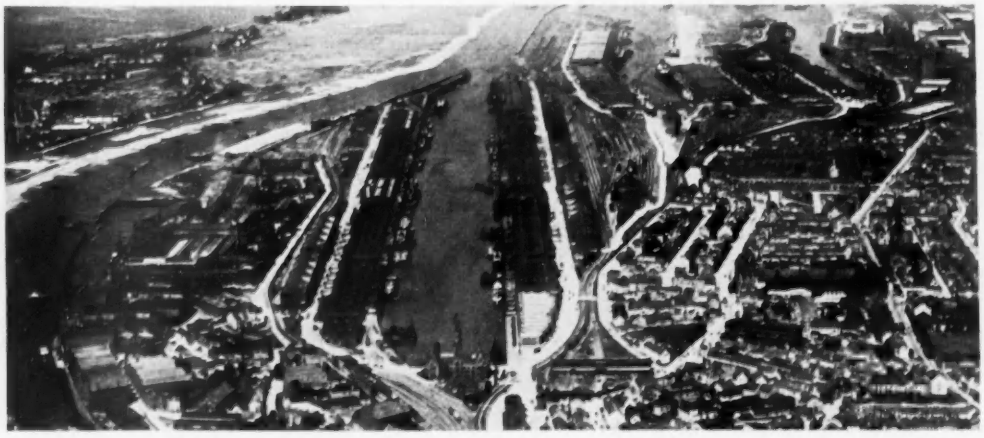

FIGURE 2.—The two free zones of Bremen lie close to the heart of the city. One hundred sixteen traveling cranes and one hundred six miles of railway trackage, besides approximately four million square feet of covered floor space, make possible the transfer and transshipment of the great amount of goods handled through this free port. (Courtesy North German Lloyd.)

The area of the free port of Hamburg is 3,340 acres. Of the area available for sea-going vessels in the entire port of Hamburg, approximately 86 per cent is located within the free zone area. The greater part, or about 57 per cent, of the numerous basins for river crafts are found outside the free zone. Fifty of

Hamburg's one hundred and five miles of waterfront are within the free port. The length of all the berthing space in the port for sea-going vessels is twenty and one-half miles; practically all of this lies within the free port, only about a mile and a half being outside. Most of the berthing space for river crafts remains outside the free port area. The area of covered floor space in the warehouses totals more than eight million square feet, five and one-half million of which are controlled by the *Freihafen-Lagerhaus-Gesellschaft*, a semi-official organization handling the leasing of warehouse space in the free port. Two hundred twenty-seven miles of railway track along the quays connect them with the German railroads. Most of the quays are operated by the city, but a few have been leased to shipping companies, who also lease some of the sheds erected by the city. Lighterage, towing, and trucking are all under private control. Private entrepreneurs handle transshipment in midstream. The free port institution, as a whole, is controlled by a board made up of representatives from a score or more of political, civic and commercial bodies in the city.

Strictly speaking, only the breaking up of lots for distribution and the assembling of larger shipments are permitted without permission in the free port; for any further treatment or refining of goods special permission must be obtained. Such permission is, of course, readily granted. Living quarters may not be established within the free port. Attempts are made to prevent personal use and consumption of dutiable goods in the free port. Retailing, peddling, and buying from members of ships' crews are also prohibited. Persons or firms renting quarters in the free ports must keep accurate account of the movement of their merchandise and are required to preserve their accounts for a period of ten years. The lessee is responsible for any violations of postal, customs, or tax laws taking place on the premises that he has leased.

The manufacturing plants and the shipyards occupy 2,800 acres, or more than half of the total area of the free port. Of the various industrial establishments, the shipyards are the most important; approximately half of Hamburg's shipyards are located in the free port. Among them are such prominent concerns as *Blohm & Voss*, builders of the *Leviathan*, the *Majestic*, and the *Berengaria*, and the *Wulkan Werft*, builders of the *Europa*. There are also extensive facilities for the repairing of ships. In 1928 there were 25,000 persons employed in manufacturing in the free port of Hamburg, of which number more than 10,000 were engaged in shipbuilding and allied industries. There is reason to believe that manufacturing would have become even more important had there been sufficient space within the free port for the accommodation of additional industrial plants.

The geographical location of Hamburg has made the port an excellent transshipment point for goods transported up and down the Elbe, which is navigable for 540 miles, or up beyond Prague in Czechoslovakia. Although Hamburg's importance as a commercial city dates far back in history, the city did not gain its present strength until rather recently. During the Hanseatic period Hamburg was overshadowed by Lubeck and Wisby, but gradually, beginning with the securing of a charter from Friedrich Barbarossa in 1189 that exempted the city from the payment of customs duties on the Elbe, Hamburg advanced until it became the leading commercial city in Germany. The establishment of the free port proved to be an additional stimulus in this growth, shown most clearly by the

enormous increase in the volume of business of the port of Hamburg from 1890 to 1914. This increase was only partly due to a greater industrial activity in the German hinterland; most of it was the result of the growing re-export business from Hamburg to Russia, Scandinavia, Holland, and the rest of Europe. Before the war Russia bought 52 per cent of all her imports from Germany, but a large proportion of these 52 per cent constituted American-made goods warehoused in the free port of Hamburg and reshipped to Russian ports in the Baltic. The opening, in 1895, of the Kiel Canal between Hamburg and Kiel proved to be a great impetus to the transshipping trade to Baltic ports. It is hardly conceivable that this very profitable business, which was Hamburg's greatest source of income, would have been possible without the free port with its excellent equipment for handling and warehousing cargo, and its absolute freedom of reshipping. In one of his reports, United States Consul General G. Bie Ravndal states that "—the part played by Hamburg's free harbor in properly handling and encouraging its enormous overseas trade can not be overestimated. The free harbor, with its extensive storage accommodations, its low warehousing costs and handling charges, its facilities for repacking, refinishing, or actually manufacturing in the free port, constitutes the very center of Hamburg's commercial life, and Hamburg's position as the leading port of Northern Europe is inextricably bound up with the free port. It is impossible to disassociate Hamburg from the free port, even in one's mind, as historically and commercially they are one. Should the free port be abolished —an unthinkable step—Hamburg would no longer be able to maintain its position as a world factor in the various commodity markets, such as rice, jute, crude rubber, cocoa beans, hides and skins, and so forth. The port doubtless would continue to be used, but merely as a port of entry for goods being shipped into Germany." This enormous foreign trade has also afforded lucrative opportunities for the shipping firms of Hamburg and has thus served as a strong stimulus to the growth of Hamburg's merchant marine.

BREMEN

The agreement between the Emperial Federation and the Free City of Bremen was practically identical to that with Hamburg. In 1884 Bremen finally declared its willingness to enter the *Zollverein* by October 1, 1888, but in order to retain its importance in transshipment trade, the city had to construct a free port before that date. This was no easy matter, but Bremen proved itself equal to the task and *Freihafen I* was opened on October 22, 1888. As the demands soon outgrew the capacity, an-

FIGURE 3.—Modern facilities at Bremen enable ships to be loaded, unloaded, or reloaded in the shortest possible time. Notice that the cranes are capable of transferring freight from the ship's hold directly to railroad cars even on the fourth track. This could not be done on most piers in New York where ship's gear is used. (Courtesy North German Lloyd.)

other section, known as *Freihafen II*, was constructed and opened to traffic in 1906.

The two free zones are situated close to the heart of the city. Twenty-two sheds with approximately two million square feet of floor space and sixteen warehouses holding more than one million eight hundred thousand square feet of floor space comprise the covered area. The traveling cranes number 116. There are 106 miles of railway trackage, owned by the State of Bremen. The close coöperation between the *Reichsbahn* and the administration of the free port of Hamburg in matters pertaining to movements of cargoes to and from the free port has generally been lacking in Bremen. In Hamburg the *Reichsbahn* manages the railway of the port, while in Bremen the harbor railroad is under the direct jurisdiction of the city. As a result the *Reichsbahn* has refused to consider the Bremen railway a common carrier, thereby at times causing the city of Bremen considerable embarrassment.

The regulations governing the free port of Bremen are essentially the same as those of Hamburg. The Bremen institution is almost exclusively a transshipping point; the industrial activities are confined to one establishment for the repairing of ships. The lack of manufacturing plants within the free port area may be ascribed to political reasons, as petitions from the city of Bremen for the privilege of adding manufacturing to its port activities have repeatedly been turned down by the central government. While no manufacturing takes place within the confines of the free port proper, a larger number of industries have been induced by the facilities that the free port has to offer to locate just outside the free zone. Among these plants are rice and flour mills, jute and cotton mills, oil refineries, rubber factories, iron smelters, and shipyards.

In Bremen one centralized authority does not control all facilities of the free port, but the various activities are carried on by a large number of individual

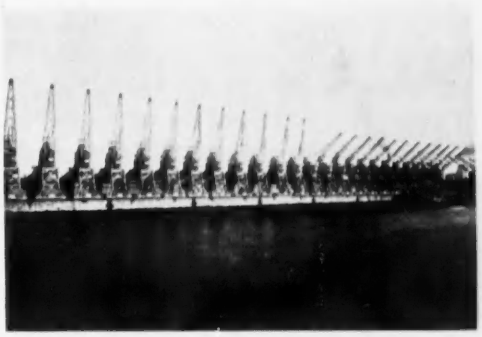

FIGURE 4.—A battery of traveling cranes at the free port of Bremen. Ten such cranes can be used for one vessel at the same time. (Courtesy North German Lloyd.)

concerns, each one concentrating upon some specific phase of the work.

Bremen's real importance as a commercial and transshipment center began with the establishment of the free port. It is not very likely that Bremen's formidable merchant fleet would have come into existence had there been no free port with the great volume of freight trade that this institution has brought to the city. Furthermore, the steamship companies, notably the North German Lloyd, have been actively interested in the establishment and the operation of the free port here.

COPENHAGEN

Prior to 1895, when the Kiel Canal was opened to traffic, Copenhagen was as advantageously located as was Hamburg. But through the Canal it became possible to ship goods from Hamburg to all the Baltic ports, and Copenhagen's prestige was severely threatened. To meet this competition the free port of Copenhagen was planned. The project was authorized in 1891, and in 1894 the

port was opened to traffic. It was built partly with private capital and partly with appropriations made by the Danish government. The free port is thus a semi-public institution and the government exerts a strong influence in its management, especially in the appointment of the Director. Briefly stated, it can be said that Denmark does three things for her free port in Copenhagen: the Government furnishes police protection within the free port area; it grants ships the privilege of buying stores free of duty inside the port; and, finally, it guarantees the interest upon the bonds issued by the Free Port Company up to the extent of 8,000,000 kronor.

In 1914 the size of the free port corresponded rather well to the volume of traffic that it was called upon to handle; in other words, the quays and the basin were never idle nor overcrowded. All the land within the fence was occupied by warehouses and, to some extent, by industrial or manufacturing establishments. Even before the war there had been some talk about enlarging it; and when the war broke out, inaugurating a period of unprecedented shipping activities, proposals were made to make the free port of Copenhagen "the largest of the North" in order to take care of an expected increase in traffic when Europe returned to peace time conditions and a period of general restoration. These plans received another powerful stimulus when projects were broached in earnest in Sweden for the construction of free ports in that country. The element of competition entered; Copenhagen began to enlarge its free port, and a new area representing about one-third of the original zone was added. The anticipated increase did not come about and, as a result, there is now one basin that has not been equipped with piers and has not even been connected with the free port area.

The free port of Copenhagen, 128 acres in extent, is well equipped; its quays surpass perhaps even the modern piers of New York. Piers whose total length is 15,660 feet fully utilize five basins. The warehouses number more than forty in number and cover a total floor space well over two million square feet. In addition there are about 100 buildings erected by private concerns on ground leased from the Free Port Company. The manufacture of margarine and fertilizers, the printing of books, newspapers and music, and bookbinding are prohibited within the free port. For other types of manufacturing license may be obtained from the Department of the Interior. No retail trade is permitted in the free port. Transit goods are warehoused by the Free Port Company free of charge for about two weeks, but the company does not undertake the forwarding of goods.

The ferry line between Denmark and Sweden has its Danish station in the free port and the established Danish steamship lines have regular berths in its basins. By means of the ferry it is possible to ship railroad cars directly to any point in Sweden and Norway.

The free port of Copenhagen was a great success during the first two decades of its existence. In the years from 1892 to 1906 the traffic in the entire port increased 122 per cent while the traffic of Malmö and Stockholm increased 75 and 81 per cent respectively during the same period. From 1900 to 1910 the tonnage turnover in the free port increased 100 per cent while that of the rest of the harbor increased only 4 per cent. However, after a steady increase that lasted up to the war period, a decline was noticed that continued until 1926, when the trend again turned upward. The slow progress of the free port of Copenhagen in recent years can be traced to several causes, such as Russia's weak-

ened purchasing power, and the competition brought about by the establishment of free ports in Malmö, Sweden, just across the Sound, and in Gothenburg. The latter port, through its very progressive transatlantic shipping business, has apparently captured the greater part of the Swedish trade formerly carried by the Danish shipping lines. The establishment of direct lines between the United States and Danzig and Gdynia has greatly reduced the volume of transshipping to these ports. It can be said, therefore, that the retarded development has not been due to any intrinsic weaknesses of the free port as an institution, but to these extraneous factors.

STOCKHOLM

The establishment of free ports within the domains of Sweden was authorized in 1907, in which year the *Riksdag*

FIGURE 5.—An example of Baltic commerce, the most important shipping connections between Stockholm and other Baltic ports. Copenhagen and Gothenburg are equally well served, and Hamburg and Bremen also maintain regular connections with the more important ports in the Baltic.

passed the Free Port Act. After preliminary investigations, a temporary free port was constructed, being ready for use in 1919. Simultaneously, a larger port was also being built which, having reached completion in 1926, was merged with the former. Together they constitute a well-equipped free port considered to be one of the most modern in the world. The area has been extended from time to time. In 1929, on the tenth anniversary of the opening of the free port, the Ford Motor Company signed a 49 year lease for a large tract of land on which to erect a new storage plant. Again, in 1931, it was decided to enlarge the free port; the plans call for a new warehouse and additional crane equipment. The total area of the Stockholm free port, which is Sweden's largest, comprises about 138 acres, the *terra firma* of which is more than 70 acres. The aggregate floor area of the warehouses is about 500,000 square feet and the length of the quays about 4,000 feet. Within the free port area are found the offices of the Free Port Company, a branch post office, and telegraph and railway offices. The Stockholm airport adjoins the free port zone.

The free port was constructed by the city of Stockholm. It is not, however, operated by the city, but leased to a limited company with a paid-in capital of 500,000 kronor, all subscribed by the city. By means of this form of administration, a purely municipal working organization has been avoided, and a more adaptable and business-like operation of the port has been attained. The authority of the city lies back of the institution, but the free port is not encumbered by rules and regulations to the same extent as is a city department. In the terms of the lease, the purpose of the free port is to benefit commerce and shipping, and the administrative policies must lead to this end. The Free Port Company undertakes the control of consignment shipments and gives out the goods in accordance with instructions furnished. It also undertakes to collect accounts that are due, and handles in-

surance and mortgaging of goods in storage. Retail trade is prohibited in the free port and manufacturing may take place only by permission of the Government.

The location of Stockholm makes the city an excellent reshipping center. Its hinterland can be said to include not only central and northern Sweden, but also Finland, Russia, and the Baltic republics. As a consequence the transshipment business in the port is extensive, especially during the winter months when the ice prevents overseas vessels from calling at the ports along the eastern Baltic. Between Stockholm and Finland there are generally daily connections; in winter they are maintained by means of subventioned vessels reinforced for traffic in the ice. Both transshipment and consignment trade increased greatly since the establishment of the free port. From 1925 to 1930 the volume of business of the free port almost tripled. On the basis of customs duties collected, the Stockholm free port advanced to fourth place among all the Swedish import harbors, which indicates the large proportion of Swedish imports that enter through the free port. More than half of all the coffee imported as well as a large part of Sweden's imports of automobiles, accessories, and tires passes through the free port of Stockholm. Large quantities of dried, preserved, and fresh fruit are also handled, both for the Swedish market and for transshipment to Finland and the Baltic countries. In recent years a considerable consignment trade has also developed in overseas products. While the Stockholm free port is primarily a distributing center for imported goods, typical export articles of the north Baltic, such as machinery, paper, and pulp, are also collected in the free port for shipment by the vessels of the overseas lines that regularly call at the free port. American traffic of the Swedish transatlantic lines predominates.

It is not likely that the very marked increase in the volume of transshipment trade that the port of Stockholm has experienced during the last two decades would have been possible without the free port. While the benefits enjoyed by the commercial and financial community of the city may not have been in direct proportion to this increase, it stands to reason that this transshipment business has contributed, at least in some measure, to the relatively rapid expansion of the commercial life of Stockholm in recent years. When it is adduced that the free port is only a competitor to the older harbor in the city, it is thereby conceded that the free port offers advantages that make it more attractive to the importers and exporters who have occasion to use the port facilities. But the influence of the free port upon the merchant marine is more difficult to ascertain. There is reason to believe that the merchant marine, both of Stockholm and the country at large, would have developed just as rapidly even had there been no free port of Stockholm.

SHIPPING AT THE STOCKHOLM FREE PORT*

Year	*Number of Ships Exclusive Barges*	*Net Tons*
1925	593	263,450
1926	582	349,833
1927	989	449,221
1928	1,121	522,305
1929	1,188	617,825
1930	1,412	734,682

* Osborne, John Ball. Commerce Report. U. S. Department of Commerce. July 6, 1931.

GOTHENBURG

The geographical location of Gothenburg favors commerce and shipping and the city has for centuries been a relatively important trading center of the North. The Gothenburg of modern times has had no less than four predecessors. The first one, *Liodhus* or Old Lödöse, was located further inland along the River Göta and flourished in the thirteenth

and fourteenth centuries. Liodhus and the later trading ports on the River Göta were all destroyed in the wars that from time to time raged in this region. The present city was founded in 1621 by Gustavus Adolphus, one of Sweden's greatest kings.

The free port was opened to traffic in 1922. At the present time the area comprises about seven acres, with additional land reserved for future expansion adjoining the present area. The quays total 3,730 feet in length with a water depth of 29 feet, and the total floor space of the warehouses and the sheds is about 250,000 square feet. Post and telegraph offices and the offices of the Free Port Company and of the harbormaster lie within the free port area.

The entire harbor of Gothenburg, including the free port, is owned by the city and administered by a Harbor Board, but a Free Port Company handles the operation of the warehouses and the transportation of goods within the free port. The shareholders of this company, capitalized at 300,000 kronor, are entitled to receive dividends not exceeding 5 per cent per annum. As the entire capital of the company is invested in 5 per cent Government bonds, the company, in order to assure this dividend, needs only fix its dues and charges at a figure sufficient to cover costs incurred in the actual operation of the free port.

Retail trade is prohibited, but permission to sell ships' stores may be secured from the Government. Manufacturing, exclusive of printing, may also take place if permission has been obtained. In common with practices in other free ports, goods imported into the free zone may not be consumed there without duty first being paid on them. No private residences may be established in the free port. Although Gothenburg is a very important shipbuilding center, no shipyards have located within the free port area.

FIGURE 6.—The port of Gothenburg, on Sweden's west coast, is the country's most important shipping center. Vessels from nearly all over the world unload here. In the Free Port section goods can be stored without payment of import duties. (Courtesy American-Swedish News Exchange.)

Because of its favorable location by the estuary of the Göta River, the city of Gothenburg enjoyed an uninterrupted growth from the very beginning up to the present time. Both the physical layout and the geographical situation of the port make it conducive to an extensive transit trade. Although the turnover in the free port is relatively large, the consensus of opinion among the merchants of the city seems to be that their formidable reshipment business is not due to the free port, but to the superior location of the harbor and the excellent shipping service that is maintained with practically all commercially important parts of the world. In fact, there are those who contend that the free port has been of greater benefit to foreign exporters than to Swedish firms. Consul H. C. von Struve, in one of his reports, has given expression to the same view.

TOTAL NUMBER AND CAPACITY OF VESSELS ARRIVED AT AND DEPARTED FROM THE FREE PORT OF GOTHENBURG *

Year	*No.*	*Net Reg. Tons*
1923	2,155	1,646,746
1924	2,657	2,034,971
1925	2,823	2,147,555
1926	3,345	2,189,266
1927	3,632	2,565,445

* Board of Engineers, *op. cit.*, p. 116.

He states: "While the inauguration of the free port has proven to be of considerable advantage to a number of American and other foreign exporters and to some Swedish importers, the operations conducted in it can hardly be said to have had any large influence either on the development of foreign trade or of the Swedish merchant marine."

CONCLUSIONS

It has been proposed that free zones be established in American ports of entry, because such zones, it has been alleged, would greatly aid American foreign trade and shipping. Attention has been called to the beneficial effects of the activities of many of the free ports abroad and it has been held that similar benefits would accrue in this country were such free zones to be established here.

The foregoing discussion endeavored to give a brief description of the development and activities of a few free port institutions in Europe, *e.g.*, Hamburg, Bremen, Copenhagen, Stockholm and Gothenburg. It appears that of these free ports—and they are by far the most important ones in existence—those of Hamburg and Bremen, and to a less extent, also that of Stockholm, have enjoyed the greatest degree of success and have been of greatest benefit to the foreign trade of their respective cities and countries. The reason for this may not be easy to ascertain, but the location factor seems to have been the most important. In order to promote foreign trade and commerce, a free port requires a favorable location with regard, not only to the immediate hinterland, but also to the proximity of foreign countries that find it advantageous to trade through the port. Hamburg, Bremen, and Stockholm seem to possess these characteristics to a marked degree. There are several other free ports, such as Copenhagen, Gothenburg and Malmö, which have been only moderately successful. In the case of Copenhagen and Gothenburg certain characteristics peculiar to each have been responsible for the less rapid development of the free ports proper. The promising growth during the early period of the existence of the free port of Copenhagen was checked by post-war developments in northern Europe and the benefits derived by Danish business men from the free port have consequently been rather circumscribed. In Gothenburg the advantages of location and well-established commercial connections over a long period of time have built up and maintained a large volume of foreign trade upon which the free port seemingly has exerted only a slight influence. When all the free ports of Europe are considered, however, it appears that the free zones that have been established in conjunction with the larger ports of strategic location have exerted the greatest positive influence upon trade and shipping.

The fact that some of the European free ports have been very successful undertakings does not necessarily mean that similar institutions established here would prove equally profitable. There is, to be sure, a lesson to be learned from the results obtained abroad, but worthwhile deductions may be drawn only in so far as the political and geographical conditions of northwestern Europe and this country are similar. In the opinion of the present writer the greatest benefits to be expected from free ports are those that these institutions will render in connection with the re-export trade. The anticipated usefulness of free ports in American harbors should thus be considered on the basis of the extent to which American business men in the future may be expected to participate in the

distribution of the products of our neighbors, *i.e.,* Canada and the countries of Central and South America, as well as in the assembling of the goods that these countries import from other continents. Provided conditions are favorable, it is not at all inconceivable that a formidable trade of this type might develop; and favorable conditions in this connection would necessarily include free zones in strategically situated ports of the United States. But in any serious consideration of the problem, the location factor must be given its due share of attention.

APPLE INDUSTRY OF THE WENATCHEE AREA

Otis W. Freeman

ONE apple out of every eight that compose the commercial apple crop of the United States comes from the Wenatchee-Okanogan area in north central Washington. This area averages nearly 17,000 car loads of apples annually from about 1,400,000 trees planted on 20,000 acres. The natural and human factors that unite to account for this remarkable record merit investigation.

The agricultural Wenatchee valley extends from Columbia River to Leavenworth, a distance of about twenty-two miles between Wenatchee Range on the south and Entiat Range to the north. Along Wenatchee River only small intermittant flood plains exist. Above the stream, level gravel terraces have been developed and constitute the most important fruit land. In addition, man cultivates the gentler slopes of the hills and some upland surfaces that lie below the irrigation ditches. Including such areas Wenatchee valley developed for fruit generally ranges from one to two miles in width, and increases to about six miles along Columbia River at the city of Wenatchee. The Wenatchee area includes Wenatchee valley, East Wenatchee across the Columbia from the valley, Wenatchee Heights and Malaga districts south of Wenatchee, the Entiat-Orondo district about fifteen miles north of Wenatchee, and the Chelan district still farther away. The term Wenatchee-Okanogan area includes the districts mentioned plus Okanogan valley, apples of which are marketed with those from Wenatchee. In the Wenatchee area fruit, chiefly apples, comprises almost the entire income from the farms. A greater production of apples comes from this section than any other area of similiar size on earth.

Climate

The climate of the Wenatchee area favors the production of quality fruit, especially apples.

While only one hundred miles from the Pacific, Wenatchee valley lies to leeward of the Cascade Mountains and therefore possesses a continental climate instead of the oceanic climate that its location would ordinarily afford. The rainfall at Leavenworth near the west end of the valley and closest to the high mountains totals 21.37 inches annually.

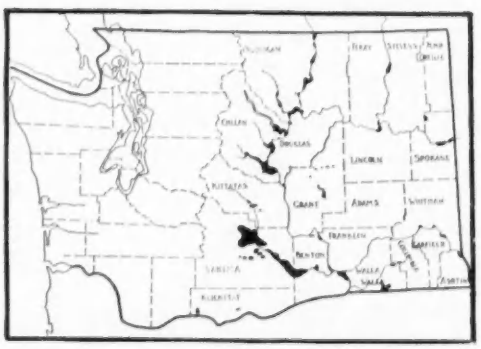

FIGURE 1.—Apple-producing areas and districts of Washington. Wenatchee valley is the largest producing area in Chelan county, and Wenatchee area includes portions of Douglas county bordering Columbia River. (From Bull. 242, Agricultural Experiment Station, W. S. C., Pullman, Wash., by Hampson and Dummeier.)

Precipitation rapidly decreases eastward because of less elevation and greater distance from the mountain storms. Annual rainfall totals 17.15 inches at Dryden, 9.70 inches at Wenatchee and 7.35 inches at Rock Island, a few miles down the Columbia below Wenatchee. Practically one-half the rainfall at We-

natchee falls during December, January, and February. The rainfall during the growing season is too light and uncertain for any dependable use. Wenatchee area has a desert to a semi-arid climate and requires irrigation.

Mean annual tempertaures in Wenatchee area are 48 degrees to 50 degrees Fahrenheit. Winter temperature at Wenatchee averages 27.4 degrees F., and summer 66.5 degrees. Zero temperatures rarely occur. Average date of the last killing frost in spring is April 20 and of the first killing frost in fall is October 25, giving a growing season of about two hundred days. The length of the growing season decreases westward toward the mountains, and at Leavenworth has dropped to 155 days. Apple production requires close to 150 frost-free days. Some orchardists have provided orchard heaters for frost protection during the blossom season, but in most years frost does little damage. Wenatchee valley seldom has suffered losses resultant from hail and high wind injury to fruit. Along Columbia River strong winds sometimes cause injury to young orchards.

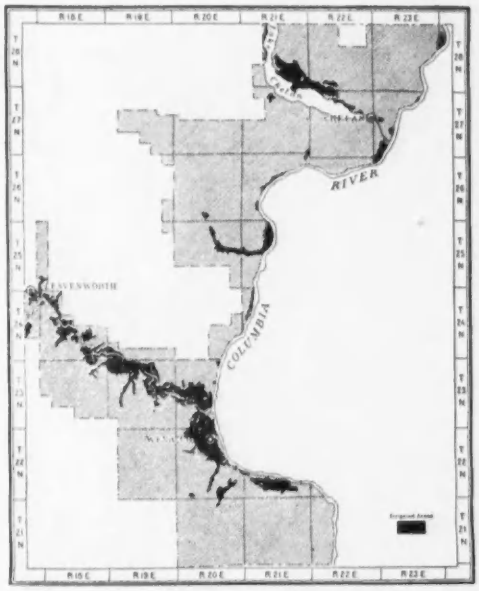

FIGURE 2.—The location of the irrigated areas of Chelan county. (After A. E. Kocher, "Soil Survey of the Wenatchee Area," Washington, 1922.)

SOILS

According to A. E. Kocher (Soil Survey of the Wenatchee Area), Wenatchee area includes an unusually wide range of soils because of the extreme differences in climate, topography, and other factors that have affected the soils. He recognized eighteen soil series, comprising thirty types and eleven phases. In Wenatchee valley proper soils are less diverse and may be classified into a few groups. Here most of the soils have been formed from material transported by running water, wind, and glaciers. Such soils are little influenced by variations in the character of bed rock. Residual soils have developed mainly in the higher hills and mountains. To the apple grower the most important soils belong to the Wenatchee and Cashmere series.

The Wenatchee series has developed on nearly level terraces. It includes a brown to gray-brown top soil, with a rather compact yellowish-brown calcareous subsoil. This soil seldom carries gravel. The native vegetation was sagebrush, with the result that Wenatchee soil is deficient in humus.

The Cashmere series includes brownish soils underlain by lighter brown subsoil. Typically, this soil has developed on alluvial fans and slopes at the base of hills. The soil material has been transported so recently from regions of greater rainfall into a sagebrush desert that the desert climate has not yet changed the soil characteristics of a humid climate.

Less important soils include the gravelly gray-brown Beverly series developed from recent alluvium on low terraces near Wenatchee River, and the sandy Pasco series developed from bottom

lands subject to overflow from streams.

Near Leavenworth at the head of the agricultural valley with more rainfall than at Wenatchee, the Leavenworth soil has developed from alluvial deposits. This soil is dark brown, non-calcareous, and high in organic matter. Between Peshastin and Leavenworth the chief soil type is the Lick series. This type, developed from undulating glacial deposits, has a light brown color with a yellowish subsoil, and generally good drainage.

Wenatchee valley soils generally contain sufficient nutriment with the exception of nitrogen. A cover crop of alfalfa is grown in most orchards to supply needed nitrogen and other organic material. Alfalfa hay is rarely removed from orchards. Barnyard manure is frequently added to orchard soils, but commercial fertilizer has seldom been used.

FIGURE 3.—Surface irrigation in a Wenatchee orchard. Usually four or six furrows, each about six inches deep, distribute the water from the main canals.

IRRIGATION

Originally only gray-green sagebrush bedecked Wenatchee valley, while scattered bunch grass and stunted trees dotted the surrounding hills and open woods clothed parts of the upper valley. The region lacked a railroad, and river transportation to Portland was prevented by rapids on the Columbia. In 1887 there were only five families in the whole Wenatchee valley. The first effort to irrigate the desert was the Miller ditch built at Cashmere in 1883. Early homesteaders installed water wheels along Wenatchee River for irrigation and also utilized small tributary streams and springs. Fruit trees were planted experimentally, and the resulting fine stock began to attract attention in Seattle and eastern United States. In 1892 the Great Northern Railroad crossed the valley, thereby providing transportation to market and impetus to increased immigration. In 1896 Warner Flat, near Cashmere, was irrigated, and the ditch that supplies Peshastin and Dryden was built from 1892–97. When Wenatchee valley fruit won first prizes at the Pan-America Exposition in Buffalo and at other expositions, capital began to be interested in the development of large irrigation projects. In 1904 Cashmere (named after the Vale of Kashmir) shipped ninety-three car loads of apples.

High Line ditch, begun in 1892, reached Wenatchee in 1904. This canal waters 9,000 acres in Wenatchee valley and is the most important irrigation unit in the area. Water from the High Line was later carried across Columbia River to serve 5,000 acres in the East Wenatchee district. The water comes from Wenatchee River near Dryden, flows by gravity along the north side of the river to within a mile of the Columbia, then crosses Wenatchee River by a bridge to supply the large flat adjoining the city of Wenatchee. The Gunn ditch takes water from Wenatchee River at Monitor and irrigates land at a lower elevation than the High Line. Other irrigation canals are the Olive ditch that waters high level land on the south side of the river

near Monitor and Cashmere and the Jones-Shotwell, which serves land at a lower elevation in the same area. Icicle canal secures water from Icicle Creek and irrigates 4,000 acres on the north side of Wenatchee valley between Leavenworth and Peshastin. Near Cashmere, Mission Creek valley is irrigated from the stream that flows through it. On Wenatchee Heights about 400 acres secure water from a reservoir in the mountains. A total of 15,000 acres of fruit in the valley are irrigated from the sources mentioned. Over 11,000 acres of irrigated fruit lie between Wenatchee and Cashmere.

On the Wenatchee district outside of the valley itself, nearly 2,000 acres at Malaga are irrigated chiefly by pumping from Columbia River. Along the Columbia at Winesap, Chelan Falls, and other available sites, between Wenatchee and Chelan Rivers, several small acreages secure water by pumping from the same source. Entiat valley secures water from Entiat River by gravity. Nearly 2,000 acres at Manson and along the shores of Lake Chelan have been irrigated by pumping from Lake Chelan and Wapato Lake, the latter a nearby slightly brackish body of water.

Wenatchee River is fed by springs and melting snow in the high Cascades during the summer season. The volume of soft water very suitable for irrigation is entirely adequate. In fact more water exists than land for irrigation. All large areas of available land have been developed, and further expansion within the valley is practically impossible.

The irrigation season lasts about five months, from the middle of April to the middle of September. Most orchards use surface irrigation and distribute water by four to six furrows about six inches deep between the rows of trees. A few orchards have underground pipes for sub-irrigation around the root zone of the trees. Others use a sprinkler system. Ground sprinklers of the revolving re-action type have proved more satisfactory than overhead sprinklers. By the sprinkler system thirty to thirty-six acre-inches of water during a season suffice for a mature orchard when applied without waste. Furrow irrigation requires about ten inches more than sprinklers. However, installation of a sprinkler system costs from $40 to $300 per acre, depending on the type of equipment, and this expense discourages many growers from changing from the usual furrow system. Water is applied several times during the irrigation season under the furrow method and may be applied every few days by the sprinkler method.

FIGURE 4.—Pruning an orchard during the winter when apple trees are dormant. Tractors gather and pile the brush to be burned. (Courtesy Wenoka Coöperative Federation.)

ORCHARD CULTURE

Apple trees are pruned during the winter season when the trees are dormant and other work cannot be done. Pruning eliminates dead or diseased limbs, shortens the annual growth, re-

duces the distance between branches formed in successive years, permits the strength of the tree to go into fruit production and not into useless growth, thus conserving the vitality of the tree for the production of good annual instead of biennial crops, and exposes the growing fruit to sunshine thereby improving the color. Pruning insures a compact, symmetrical tree best suited for picking and spraying, and also insures the maximum desirable number of vigorous, productive fruit spurs. Apple trees are pruned for low heads, usually about three feet above the ground. Long limbs are avoided since these require excessive propping to support a load of fruit. Pruning, begun with the first planting of the apple tree and continuing year after year, largely governs the production of quality fruit.

The brush from pruning is piled and burned. Frequently, the large limbs find use for domestic fuel supply.

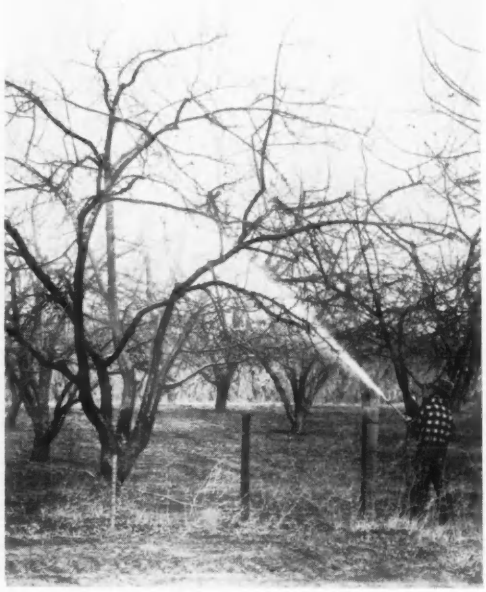

FIGURE 5.—The dormant spray is applied in the spring with the intent to control certain fungus diseases and sap-sucking insects. Lime-sulphur and oil-emulsion sprays are used. (Courtesy Wenoka Coöperative Federation.)

Spraying begins in spring and lasts throughout the growing season. It constitutes a most important part in the production of quality fruit. Orchardists provide extensive equipment to facilitate the application of spray material. Machinery consists of specially designed pumps driven by gas engines or electric motors that force the spraying liquid through nozzles at a pressure of 500 pounds per square inch. In some orchards large tanks are installed permanently at a convenient location and the spray mixture distributed from this central point by pipe lines to all parts of the orchard. Other outfits may be of the powered portable type or drawn by tractors. Hose lines run from the source of spray liquid to the nozzles that workmen use in spraying the trees.

Spraying begins in spring with the so-called dormant spray intended to control certain fungus diseases and sap-sucking insects that harm the apple trees, thereby indirectly affecting the fruit. Both lime-sulphur and oil-emulsion sprays are used.

Apple-blossom time comes in May, making the whole valley a beautiful picture in pink and white, besides filling the air with perfume. At this period orchardists import and release thousands of hives of bees to aid in the cross fertilization of various apple varieties, essential to the production of uniformly high quality fruit.

The calyx spray is applied just before the last petals fall, and covers very thoroughly each calyx cup and all leaf and twig surfaces. The chief insect damage to apples results from the ravages of codling moth larvae. Several broods of codling moths may emerge during the summer. To protect the fruit against them, cover sprays may be

applied until late August. These consist of lead arsenate at the rate of three or four pounds per 100 gallons, when used alone or in combination with a spreader such as lime, oil, and soap. Combinations of oil with lead arsenate help to control aphis, leaf hoppers, and red spiders, besides the codling moth. Certain years, like 1932, have serious moth infestation because of favorable weather conditions or some other cause, cient in protection against the codling moth, but careful spray application has reduced worm damage to around 5 per cent. The greatest danger of worm infestation lies in the lower and warmer part of the valley since codling moths are very sensitive to climatic conditions in hatching, breeding, and flight.

After the so-called June drop the remaining apples must be thinned in July. Thinning reduces the tree load, thereby

FIGURE 6.—Apple trees in blossom near Cashmere, in the upper Wenatchee valley, with the snow-capped peaks of the Cascade Mountains, in the background, that furnish irrigation water during the summer. (Photo by Simmer, Wenatchee.)

and some orchards may require spraying as many as eight or ten times. Standard practice deems four to six sprays sufficient. The intervals between spray applications are worked out scientifically by means of moth traps that give data concerning flights of moths and the laying of eggs, so that each application of poison will bring most efficient results. Lead arsenate poison has not become 100 per cent effi- allowing the crop to mature without overloading and injuring the limbs. With reduced demands on the vitality of the tree an annual succession of heavy crops is assured. Thinning removes all imperfect fruit and leaves the apples at such distances that each apple will have the best possible chance to reach perfection. Leaves manufacture raw materials from the air and soil into fruit and new wood. Experiments have

shown that each apple should have at least 30 leaves serving it in order to attain the best commercial size of 90–125 apples per box. Small size commercial fruit results from 20 leaves per apple. With only 10 leaves per apple the size of fruit runs about 200 per box, which is below profitable commercial grade.

HARVEST AND STORAGE

The commercial apple harvest begins in September, and different varieties come to maturity over a period of several weeks. Growers and representatives of marketing organizations watch the apples carefully in order to pick each variety when it reaches prime maturity. This insures optimum color, flavor, and keeping quality. Besides certain characteristics of apples recognized by fruit specialists, adjustable pressure-testing instruments are used to determine the ripeness of the fruit.

Great care is used in picking apples. Picking receptacles may be padded to avoid bruises that injure keeping quality and appearance of apples. The picked apples are hauled to packing plants for washing, grading, and packing.

Machinery first washes the fruit in a weak acid bath that sterilizes and removes all spray residue. A rinsing in cold running water follows, after which the apples pass through drying machines. Endless belts then carry the fruit to the sorting tables where expert sorters remove all culls and classify the good apples into Extra Fancy, Fancy, and C grades. Other belts convey the fruit to sizing machines that automatically size the apples and deposit them in bins padded to prevent bruising.

Each apple is wrapped individually in oiled paper to prevent storage scald. Packers place the wrapped apples in paper-lined boxes that usually contain from 75 to 180 apples, depending on the variety and size of fruit. An average packer will pack 100–125 boxes per day, but an exceptional worker may complete over 300 boxes in ten hours. The packed boxes are carried on a roller conveyer past the lidding machines that automatically nail on the top, after which each box is carefully labeled. The boxes then go into cold storage or iced refrigerator cars. The number of boxes carried in a car load runs from below 500 to over 750, depending on the size of the car and height of loading.

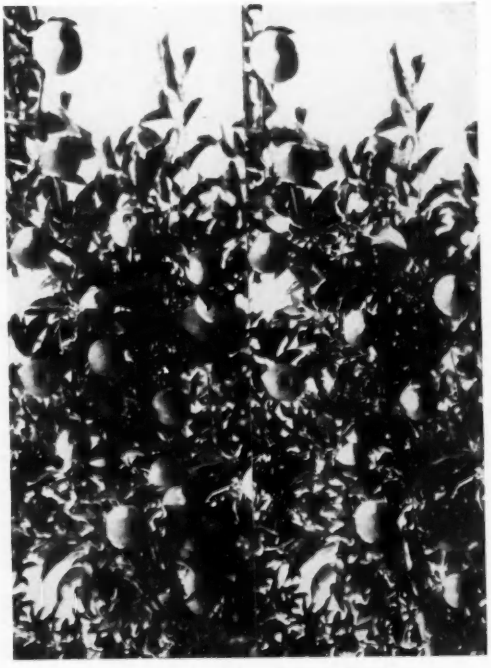

FIGURE 7.—An unthinned branch of apples on the left and the same branch on the right, but thinned, with the remaining apples properly spaced to assure full and mature development of quality fruit. (Courtesy Wenoka Coöperative Federation.)

Quick removal from outdoor heat to cold storage enables apples to keep longer, since the fruit ripens nearly five times more rapidly at 65 degrees F. than at 32 degrees F. By pre-cooling and cold storage, apples keep from October until the following summer. The long period available for marketing aids greatly in disposal of the crop.

Washington apples are relatively free from diseases. Only eight out of thirty-four serious diseases that afflict districts east of the Rocky Mountains demand attention from orchardists in the Wenatchee district.

Defects that lower apple quality include those from: fungi, like rots and mildews; insects, like codling moth, San José scale, and aphis; chemical injuries from oil spray, arsenic, or the like; bruises from stem punctures, limb rub, box pressure, pulled stems, and so forth; climatic injuries from freezing and sunburn, and internal defects like scald, water core, bitter pit, cork, and Jonathan breakdown. Care in handling fruit can eliminate most mechanical injuries. Sterilizing boxes and packing sheds with careful cleaning and sanitation of orchards prevent fruit losses from various rots of apples. Quick cooling of fruit after picking and storage at near 32 degrees F. keep most fungi from producing infections in boxed apples. By such means careful growers protect their fruit from losses that might result from storage rot and other rapid deterioration.

ORCHARD FARMS

According to the 1930 census, Chelan county, which includes Wenatchee valley, had 2,218 farms. Apples were grown on 1,927 farms and fruit of some sort on 2,021 farms. There were only 184 tenants, so that over 90 per cent of the farms were operated by owners. Of these, 1,164 farms, or 61.3 per cent, were mortgaged; a rather high figure when compared with other farming regions in the United States.

The size of farms and their number follow:

Under 3 acres	81
3–9 acres	583
10–19 acres	591
20–49 acres	425
50–99 acres	169
100–174 acres	169
175–999 acres	191
Over 1,000 acres	9

The 200 farms above 175 acres in size raise little fruit and depend for the greater part on hay, cows, and other livestock. Over half the farms are under twenty acres in size, and three-fourths are under fifty acres.

The most common size of an apple orchard in Wenatchee valley is ten to fifteen acres. This seems about the right size for the average grower to handle most efficiently. Small acreages have a high overhead because equipment costs the same as that for a larger orchard, up to a certain point. If work is hired it is difficult to get it done at the most advantageous time. Large orchards need much labor besides that of their owners. This may be an advantage in times of high apple prices and a disadvantage when prices are low. Some well-managed large orchards have proved very profitable over terms of ten to twenty years.

In 1930 there were 1,091,065 bearing apple trees and 227,024 non-bearing trees in Chelan county. Of 24,634 acres in fruit about 20,000 acres were in apples. Of the nearly 70 trees planted per acre an average of 8 bushels, or about the same number of boxes, was produced per tree.

A detailed survey was made of Section 4, T. 22 N., R. 20 E. This section adjoins Wenatchee on the west and is planted solidly to apples, except for a few acres in city lots. The county assessor found 465.35 improved acres in this section. Most of the balance of the 640 acres has been taken for roads and dwellings. One hundred twenty-one individual assessments of property were made. Exclusive of city lots, farms run from one and one-fourth to twenty acres in size, with an average of five and one-half

acres. Such small holdings necessitate numerous roads to reach the many dwellings.

The population of the square mile is approximately 600. The 465 acres of improved land was assessed for $176,550 in 1932, a total of $396 per acre for land the value of which is assumed to be twice this amount. Improvements were assessed at $85,000. The entire assessed valuation of $261,550 for one square mile of orchards and improvements is supposed to represent one-half the actual value. Some orchards in this section have in past years sold for over $2,000 per acre, depending on improvements, and so forth. Homes are established so close together, a result of the small size of farms, that electric lights, telephones, and other city improvements are available, making life pleasant for the orchardists. An average annual net income for the owners of a ten- to fifteen-acre orchard from 1920–1930 would amount to about $2,000, adequate for a good standard of living and a high purchasing power in the Wenatchee stores.

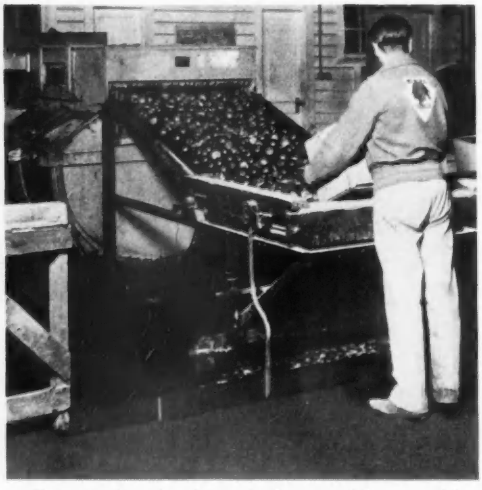

FIGURE 8.—Apples entering washing machine in a packing plant. (Courtesy Wenoka Coöperative Federation.)

COST OF PRODUCTION AND APPLE VARIETIES

A study of the cost of producing apples on 81 farms in the Wenatchee district from 1926 to 1928 by Neil W. Johnson of State College of Washington showed an average cost of $1.17 per box for fruit that sold for $1.29 per box on the average. The net profit of twelve cents per box amounted to $64.57 per acre on the average yield of 535.6 boxes. Costs included interest on all investments and allowance for wages for family labor. Thinning and picking fruit require the chief expenditures for hired labor. In 1932 labor was hired for half the wages current from 1926–28, and other expenses for boxes, spray, and so forth, were also reduced. Growers figured that ninety cents per box, net, would be a profitable price in 1932. From 1926–28 the sum of seventy cents per box approximated the actual cash expenditure of Wenatchee apple growers, and costs would probably not exceed fifty cents per box in 1932. Low prices in 1932 caused complaint by growers, yet the most efficiently managed orchards made money above wages for their owners, and ordinary orchardists at least made a living. If low prices continue, orchards with high costs resulting from poor soil, bad location for economical management, and similar maladjustments, will be eliminated.

From 1924–1928, according to the Department of Agriculture, Washington state averaged 33,306 car loads of apples shipped, or 28 per cent of a United States total average of 117,164 car loads. Of a five-year average, the commercial production for Washington was 24,617,000 bushels, or 25.3 per cent of the total United States production of 97,119,000 bushels. Washington's total production was 28,885,000 bushels,

or 16 per cent of the United States total of 180,262,000. In the eastern United States many apples never leave the farm, so are not included in the commercial crop.

During this five-year period of 1924–1928 when Washington averaged over 33,000 car lot shipments of apples per

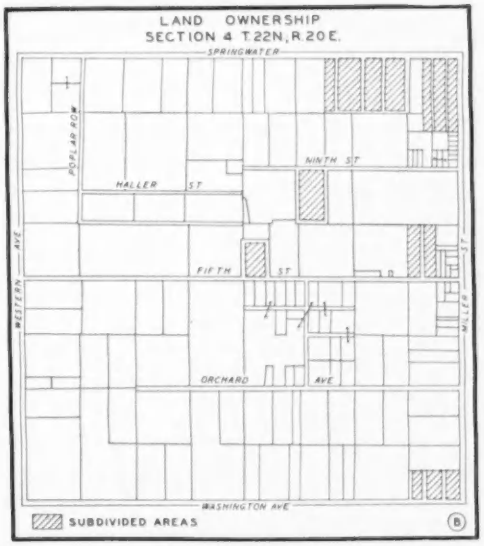

FIGURE 9.—Four hundred sixty-five of the six hundred forty acres of land in this section were improved, and the total area required one hundred twenty-one individual assessments. The size of farms averages five and one-half acres, with a range from one and one-fourth to twenty acres in size.

year, 16,947 car loads, or 51.4 per cent, came from the Wenatchee-Okanogan district. During these same years 79.5 per cent of the apples shipped consisted of the varieties Winesap, Delicious, Jonathan, and Rome Beauty. Shipments in car lots were as follows:

	Car Loads	*Per Cent*
1. Winesap	5,960	36.7
2. Delicious	3,075	18.9
3. Jonathan	2,470	15.2
4. Rome Beauty	1,390	8.5
5. Stayman	1,070	6.5
6. Spitzenberg	925	5.7
7. Winter Banana	320	2.0
8. Yellow Newtown	190	1.2
9. Black Ben	185	1.1
10. White Winter Permian	181	1.1
11. Others		3.1

The chief "other" varieties are Arkansas Black, King David, Black Twig, Grimes Golden, and Ben Davis.

The proportion of apples by grades varies in different years and for different varieties, but averages about 40 per cent extra fancy, 35 per cent fancy and 20 per cent C grade.

Average price per box by leading varieties were:

Delicious	$1.80
Winter Banana	1.32
Winesap	1.29
Yellow Newtown	1.19
Spitzenberg	1.09
Stayman	1.01
W. W. Permian	.98
Rome Beauty	.97
Jonathan	.94
Black Ben	.76

The premium of fifty cents to $1.00 in returns per box for Delicious as compared with other varieties explains why this variety makes up about 50 per cent of the new plantings of apple trees. Orchardists tend to eliminate minor varieties and less profitable ones like Jonathan, and to concentrate on the production of Delicious and Winesaps.

TRANSPORTATION

The Great Northern Railway enjoys a monopoly of rail shipments from Wenatchee valley. This railroad maintains yards, icing plant, and other facilities at South Wenatchee, where entire train loads of apples are prepared for rapid, efficient handling. On the average, a train of forty-five to fifty refrigerator cars, loaded with an average of 750 boxes of apples per car, leaves the Wenatchee Gateway every day of the year. Wenatchee valley is the largest source of freight to the Great Northern Railway between Puget Sound and the Twin Cities, Minneapolis and St. Paul.

Permission has been granted to a company for building an independent railroad, the Wenatchee Southern, to Ellensburg, where connections would be made with the Northern Pacific Railway and the Chicago, Milwaukee, St. Paul and Pacific lines, but construction

has never started. The freight on boxed apples per 100 pounds costs about one cent a pound to Mid-West points. This is equivalent to about forty cents per box. Freight charges to the eastern cities amount to about fifty cents per box. In times of low prices for apples, like 1932, only high quality fruit can afford transportation costs to distant markets, and in 1932 many C grade apples were thrown on the dump with culls, because no market was available that would cover the freight and packing costs. Considerable fruit moved via truck to Puget Sound and other markets within a few hundred miles. Improved highways make this possible. From Seattle, Wenatchee boxed apples are exported by steamer to Europe and other foreign lands.

Until 1902 all apple shipments were handled by express. No refrigerator cars were used, and few persons believed shipments would reach car-load lots. Large apple shipments came only during the last thirty years.

DISTRIBUTION

Wenatchee apples are distributed over the entire world. Even communities in eastern United States with large supplies of local apples consume Wenatchee apples in part. Every country in Europe imports the fruit. Argentina, Peru, Hawaii, China, East Indies, and Egypt are among the lands that buy Wenatchee apples.

Several coöperative associations handle most of the product. By carefully watching markets, an oversupply in certain cities is avoided and remunerative prices best maintained. Some of these coöperative organizations maintain their own sales force and have their own connections in terminal domestic markets and in some foreign countries. Other organizations dispose of the group's apples by their private selling force, but do not always attend to the actual physical handling. Some fruit is sold on consignment. The cost of selling Wenatchee apples amounts to about twelve cents per box, which includes field work, advertising, collecting, brokerage, sales cost, and assembly cost.

According to C. C. Hampson and E. F. Dummeier (Bull. 242 Agricultural Experiment Station, State College of Washington), the average price received for Wenatchee apples shipped during 1922–1927 was $1.26 per box, with prices varying from 95½ cents in 1923 to $1.72 in 1927.

The following table of car lot shipments includes some soft fruits (probably 5–10 per cent) from 1902–1911. After 1912 apple shipments were recorded separately.

Apple shipments from Wenatchee area in car loads:

1902	2	1917	7,646
1903	116	1918	8,336
1904	587	1919	12,148
1905	632	1920	9,470
1906	603	1921	14,432
1907	807	1922	13,871
1908	1,540	1923	18,418
1909	804	1924	13,510
1910	2,791	1925	16,900
1911	2,286	1926	17,507
1912	3,960	1927	15,348
1913	4,107	1928	21,733
1914	6,336	1929	19,155
1915	4,846	1930	24,386
1916	7,281	1931	19,870
1932	18,000 (Estimated)		

A recent survey of distribution of Washington apples showed that the fruit had been shipped in car lots to every state in the Union except Delaware, and this small state doubtless received some of the apples in less than car lots from some nearby large terminal market. Washington apples have sold in eastern markets in most years at remunerative prices to the grower in spite of the handicap of long distance from market and high cost of transportation. This success came from marketing standardized quality fruit in

first-class condition in a convenient package. In recent years the success of northwestern apples in their own markets has caused eastern and middle-western apple growers to plant favorite western varieties like Delicious, to carefully tend their orchards, and to produce for sale better appearing apples than formerly.

This has helped reduce prices and made increased competition for Washington apples. The Wenatchee apple growers will try to retain past customers and reach new markets by the methods that have succeeded in the past, *i.e.* continued research to insure fine quality apples, careful grading of fruit to insure high standard quality, advertising, and marketing through coöperative associations.

MARKETS AND MARKET AREAS OF EAST ANGLIA

Robert E. Dickinson

THE aim of this article is to examine and interpret the development and character of the markets of East Anglia; a region which includes most of the counties of Norfolk, Suffolk, and Essex in eastern England. It is presented not only as a geographic interpretation of local marketing within a definite region, but also purports to illustrate some of the general features and trends of modern marketing in England and Wales.

Rural Economy

The regions of East Anglia are shown on Figure 2. In the west of the counties lies a belt of Chalk Downland, a central region of sandy heath (the Breckland), and a similar sandy area (though the soil has a higher clay content) in northwest Norfolk, also formerly uncultivated, but brought under the plough with the scientific rotation introduced at the beginning of the nineteenth century (the *good sands* region of Arthur Young). The central region is essentially an undulating upland seamed by well-defined west-easy valleys. Each is covered with boulder clay that gives a heavy loam, and in south Suffolk and Essex, a heavy clay soil. This is High Anglia. Between the heavy soils of High Suffolk and the Breckland is a narrow belt of light loam soils, similar to the rich chalk marls, with some distinctive features of rural economy. Bordering High Anglia are (1) the heavy London Clays of south Essex; (2) the maritime belt of Suffolk, alternating heath and exceedingly fertile light loam; (3) the light loam region of northeast Norfolk; and (4) the low lying alluvial marshes of the north coast of Norfolk, the Broads and east Essex.

The basis of the farming of most of East Anglia is the four course system, originally introduced and rendering cultivable considerable areas of sandy soil, hitherto open sheep walks, in the *good sands* region of northwest Norfolk. This system is modified to suit local conditions and requirements, but ideally it consists of a four year rotation of—

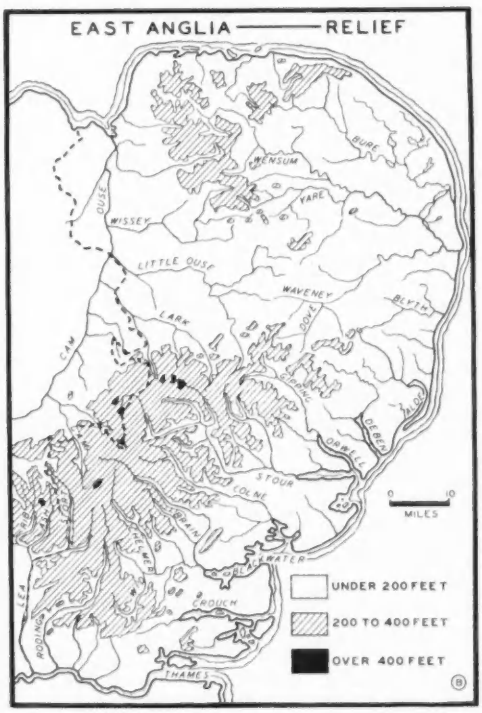

FIGURE 1.—Most of East Anglia is of slight relief, favorable for intensive cultivation on the fertile well drained soils, and excellent for the pasture of livestock where the heavy clay and poorly drained soils favor the growth of grasses.

first year, roots (mangolds, swedes or white turnips); second year, barley; third year, grass seeds (clover, trefoil, sainfoin or rye grass); and fourth year, wheat. This form of husbandry with roots and grasses entering between the

grains, fertilizes the soil by adding the manure provided by the stock fed on the land, and by the deep cultivation and heavy manuring which are necessary for the growth of root crops. Stock keeping is usually subsidiary to grain production. Cattle are fed on roots in yards during the winter months, and sheep also on roots or grasses during the summer months. By early summer, the roots are exhausted and the carrying capacity of the farm is then at a minimum. Therefore, fat stock or superfluous stores are sold off in the spring months. Stocks are then replenished in the autumn, both cattle and sheep being permitted to feed on the stubble prior to winter feeding on roots, which are ready between October and December.

The loam region of east Norfolk had, at the beginning of the nineteenth century, a six year shift, wheat, barley, turnips, barley or oats, followed finally by a two years' 'layer' (cultivated grasses), a course which is still usually followed. At the time of Arthur Young's survey, barley, roots and sheep were rapidly becoming the basis of the husbandry of west Norfolk. Here a contrast brought out by P. M. Roxby should be noted. In west Norfolk the stock are mainly sheep. It is both a breeding and a grazing area, with a heavy seasonal output of store sheep and lambs, fattened during the summer months on the north Norfolk marshes. In the east of the county, cattle are dominant, fattening on the Broadland marshes in the summer.

In High Suffolk and Essex a modified system prevails, owing to the heavy and tenacious boulder clays that offer greater difficulties in cultivation and are, moreover, not suited to the wintering of sheep. The mud sticks to their wool, and after rains, they puddle and sodden the soil. The course of crops in Young's time—in High Suffolk—was (1) fallow, (2) wheat, (3) oats or barley, and

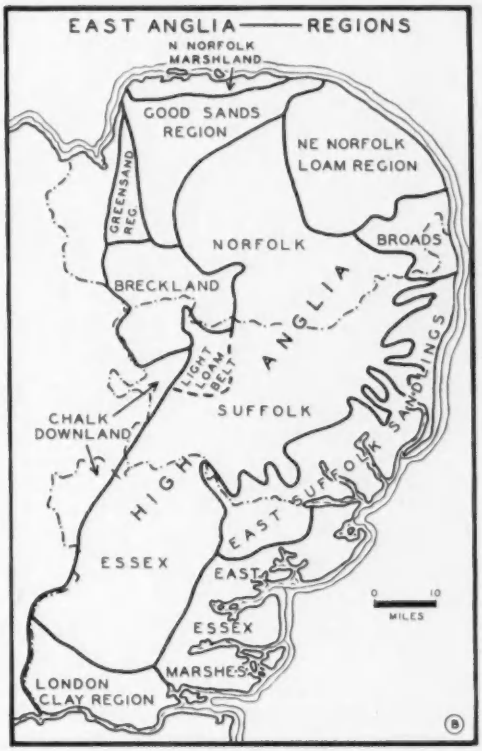

FIGURE 2.—The regions of East Anglia, based chiefly on relief, soil, and agriculture.

(4) fallow. Northwest Essex is designated by Young as the "crop and fallow" district of strong loam with the following rotation: (1) fallow, (2) wheat, (3) fallow, and (4) barley. Beans and clover (or tares) were the principal fallow crops. At this time, High Suffolk and Essex were the seats of a flourishing dairying industry, providing for the London market butter and fatted calves. The distinctive features of this belt are admirably brought out on the maps in the "Atlas of Agriculture of England and Wales," by M. Messer (1932), which show the distribution of bare fallow, peas and beans, and mangolds. The four course system is followed today, the principal change having been produced by the introduction of the mangold. Owing to the heavy soils, different crops from those of central Norfolk are grown in the rotation

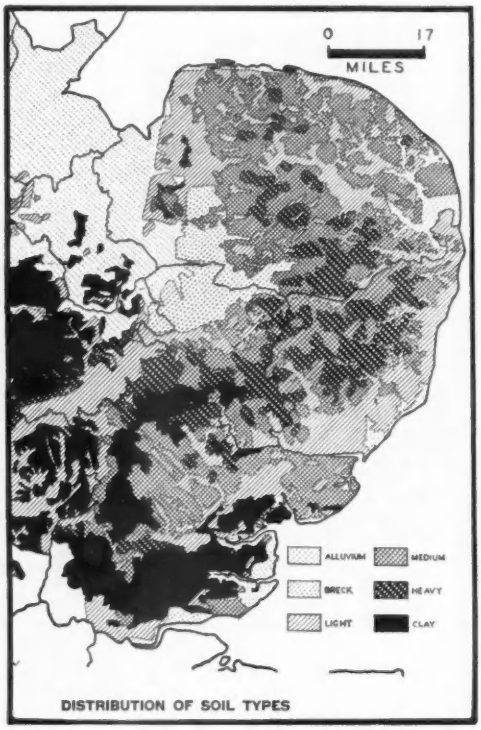

FIGURE 3.—East Anglia is primarily a grain area, over 60 percent of the agricultural area of Norfolk, Suffolk, and Essex being devoted to arable farming, the remainder being permanent pasture and heath land. Two new features of rural economy gaining prominence since the War are the cultivation of sugar beets in the light loam soils of Norfolk and Suffolk and the increase of dairy farming in the heavy clay soils, especially in east Norfolk and south Essex.

and periodically bare fallow is essential. Thus, we have, as the present rotation: (1) fallow—either bare fallow, tares or mangolds, which here take the place of turnips; (2) barley; (3) grass—clover, but, to a very great extent, peas and beans; and (4) wheat. The recurrence of a bare fallow is necessary every four or eight years to clean and improve the soil by repeated ploughings. The deep hoeing and clean cultivation of peas and beans are also a good preparation for wheat. Mangolds have improved the cultivation of heavy land more than any other single crop, and they fill up a gap which used to occur in the feeding of sheep and cattle on heavy land in the spring months.

SHEEP

In the heavy clay areas sheep are usually *grazed*, not *raised*, as they cannot be carried through the winter. Farmers buy at the summer sales and keep the lambs (store), with some artificial food, on the clover and stubble until the roots are ready, then fatten them during the winter and sell in spring. The sheep breeding and winter feeding areas are on the light and mixed soils. The heaviest sheep population is associated with the barley and root system of west Norfolk, thinning out to the south towards River Waveney. In Suffolk, there are two distinct areas of less concentration; the maritime belt of east Suffolk, and the light loam belt of central west Suffolk, which links up the sheep areas of northwest Norfolk and the Chalk Downlands.

The light loam belt lies between the heavy soils to the south and the Breckland to the north. Here, while wheat and barley are the staple crops, the easily worked light soil has rendered possible the adoption of methods of intensive husbandry, with a view to increasing livestock carrying capacity—particularly lambs. Such expedients, rendered possible by the relatively light soil, are impossible on the heavier clays. Pasture land is used to a greater extent than on the heavy land, and the aftermath is a good beginning for animals bought in the autumn for winter grazing, while winter pasture is an excellent change for ewes and lambs when the turnip crops are nearly finished.

On the light sandy soils of east Suffolk, with a husbandry based on barley, turnips, and the open heath, there are also raised and grazed large numbers of sheep and lambs, the system depending on the combined use of heath and scattered patches of arable land. The same system is followed in the farms bordering the Breckland in the light loam belt. In both these areas, the lambs fall in

February and March and are kept on the ewes until June; they are then fattened with cake and sold in July and August. Farmers who do not breed, buy in supplies of stores in summer, and keep them on clover, stubble, and turnips, which are folded off on the ground. The hoggets are usually kept till shearing time and sold in May and June. Sheep in Essex are grazed mainly in the northwest and northeast arable portions of the county. Elsewhere in this county they are very few, though some are fattened on the eastern marshes during the summer months. In the London clay and heavy boulder clay areas they are relatively negligible.

CATTLE

Cattle are fairly evenly distributed in East Anglia except for the Chalk uplands and the Breckland. In Essex their distribution is controlled by two main factors, the distribution of heavy soils, and proximity to the London market. Dairy cattle are predominant in the county, particularly in its southern half, on the heavy clays and the eastern marshes. In the arable northern section, on the chalky boulder clay and light loams, they are fewer in numbers, here fitting into the rural economy as in the counties to the north, i.e., a few winter yard-fed cattle, imported in the autumn. This distribution is naturally to be correlated with the distribution of permanent grassland, which is mainly concentrated south of River Blackwater, where permanent grass often reaches as high as 50 to 70 per cent of the total area of arable and grassland.

The same method of cattle fattening prevails throughout the greater part of East Anglia, winter stall-feeding on roots being the universal custom. Stores are bought in the autumn and sold off in spring as fat cattle, or as stores in "forward condition," to be fattened by graziers during the summer. The summer pastures for fattening are concentrated mainly in the Broads of east Norfolk, and south and east Essex. Here grazing farmers buy in supplies in the spring and sell off as fat cattle in the autumn. Many farmers also include a part of the marsh in their farms and transfer their cattle thither in the summer and back to the yards or their farms in the winter. In the west Norfolk Uplands, the Breckland, and the East Anglian Heights, cattle are few, for these are mainly sheep areas.

PIGS

As one would expect in a grain growing area, there is a uniformly dense pig population, though the greatest numbers are located in central Suffolk. The two great sources of demand for pigs are the bacon and pork trades. The demand for bacon shows no seasonal fluctuations. The demand for pork however, is usually greatest during the winter months (October–April). Hence, the breeding of pigs is so arranged that the fat pig market is well supplied in autumn and spring. There are two peaks for the country, as a whole, in the store pig market, the first in May or June for the early farrowings, the second in October and November for late (summer) farrowings. Seasonal fluctuations in pig sales are therefore due in the main to the *fluctuations of demand*, the method of pig raising and fattening being adopted to suit the demand. This is in contrast to the marketing of both sheep and cattle.

GRAIN

Barley is the most important single grain crop in both Norfolk and Suffolk, though more so in Norfolk, where it is heavily concentrated in the western half. It is relatively of much less importance in the eastern half, in the northeast loam region and the Broads. It is evenly distributed throughout Suffolk and Essex,

thinning out, however, to the east, in the maritime belt of Suffolk and the marshes of east Essex.

Wheat shows a similar uniform distribution, but it is not so hardy as barley, and prefers a damper, deeper, and heavier loam. This is well shown, for instance, in west Norfolk where barley, in contrast to wheat, is cultivated over most of the thin soil that covers the chalk (c.p. Lincolnshire). Similarly, wheat is almost absent on the Breckland, whereas barley is the standard grain

FIGURE 4.—Grain, livestock, and produce dominate the markets of East Anglia today, as they have done in centuries past.

crop. Wheat, in other words, is largely complementary in its distribution to barley. Moreover, the density of its cultivation increases to the south. In High Suffolk, for every hundred acres of cultivated land, fifteen are under wheat and nineteen under barley. But the same thinning out is apparent, as one would expect, in east Suffolk. In Essex, wheat is the dominant crop on the boulder clays and the rotation is comparable to that of High Suffolk. It is, however, absent from the London clay areas, which are mainly under permanent grass.

The harvesting of wheat commences in July and lasts until October, and during this period large supplies are rushed in to the market. Some 45 to 50 per cent of the recorded sales are transacted during the four months, September to December, and over 75 per cent in the seven months September to March. The rush to market of barley is even more pronounced than in the case of wheat; 60 per cent of the sales are effected during October to December and 80 per cent September to January. This is mainly due to the seasonal variation in the manufacturing demand for malting barley.

MARKETS AND FAIRS IN THE EARLY NINETEENTH CENTURY

In the early nineteenth century the markets of a rural area such as East Anglia supplied provisions, mostly from produce sold in the market place, often in hired stalls, by the farmers themselves. Up to the early nineteenth century very few live cattle were sold at the weekly markets—a few to the butchers to supply the town dwellers with sufficient meat, for the neighboring farmers supplied their own requirements. The cattle sales in those days were effected generally at the fairs and necessarily so, prior to the development of rapid transport. The corn trade was, in the main, a local trade and nearly all the market towns were the scene of buying and selling of corn, usually in some inn, and the local craftsmen exhibited their wares in stalls in the market places. All the markets were supplied with "corn, provisions, meat and every article for domestic use"—a sentence which is frequently repeated in describing the towns in early works and directories. At the larger markets such as Bury, Kings Lynn,

Norwich, Ipswich and Colchester, fish, fruit, and vegetables were also sold.

Dairying at the beginning of the nineteenth century was the principal form of agriculture in the boulder clay lands of High Anglia. High Suffolk, was, according to Defoe, "wholly employed in Dayries, and they again famous for the best butter and perhaps worst cheese in England." This belt, corresponding to the "Woodlands" region of nineteenth century writers, was continued north into south Norfolk, and south into central and northwest Essex. This accounts for the sales of dairy produce at many of the markets, the sale of cows and calves at the fairs, and the export of produce through the ports to London.

Fairs in the early nineteenth century were of much more importance than they are to-day. Held in spring and autumn, they displayed "the best black cattle, fine north country shorthorns and large Welsh runts" (Victoria County History of Suffolk) brought to the country fairs by drovers. These were bought by East Anglian farmers, fattened during the winter, and resold in the spring, ultimately reaching the London meat markets. This fattening of North Country cattle en route to London disappeared with the advent of the railway.

MARKETS AND MARKET AREAS IN THE TWENTIETH CENTURY

The markets of East Anglia are held to-day for the sale of retail produce, fruit and vegetables, livestock (cattle, sheep and pigs) dairy produce and poultry, corn, provender, and wool. The great majority are held in established market towns, though a few separate auction marts have been established in recent years. The market place, the central feature of the typical English market town, where formerly all the business was transacted, is now tenanted weekly by small retailers, selling from

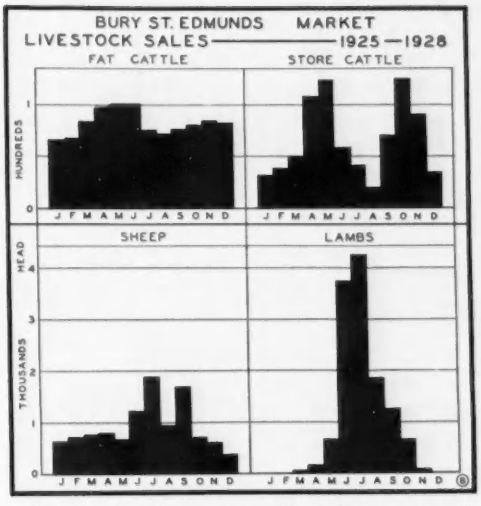

FIGURE 5.—Average weekly sales per month for the period 1925–1928 inclusive, at Bury St. Edmunds.

hired stalls, while the livestock is sold in specially constructed yards, and grain, provender, general produce and so forth, are sold in the Corn Exchange building.

Today, the retail trade has largely passed to the regular shopkeeper, livestock sales are effected weekly by auctioneers, and much of the business is done by large dealers who cater for the long distance transfer of store cattle and for the supply of large consuming centers with fat stock. In the stock rearing and grazing counties (e.g., Devon and Cornwall), there are, in addition to the market towns, many small auction marts in small villages and along the railways, serving as local collecting centers. In the grain counties, however, the markets are mainly located in the towns and are, therefore, fewer and farther apart than in the western counties.

Yet, owing to the development of transport, and the concentration of business, many of the markets have negligible sales. To-day livestock and grain are the largest items in weekly market activities. The only markets selling in the aggregate more than 100,000 stock per year are Norwich, Ipswich, Kings

Lynn, and Bury St. Edmunds. Fifteen per cent of the stock marketed in Norfolk passes through markets that handle under 10,000 head per annum, 17 per cent in Essex and 10 per cent in Suffolk.

The following figures give the number of markets in each county, classified according to their size:

NUMBER AND SIZE OF MARKETS IN EAST ANGLIA

		Markets Handling				
County	*Total*	*5,000*	*5/10,000*	*10/20,000*	*20/100,000*	*Over 100,000*
Norfolk	25	8	3	8	4	2
Suffolk	16	4	2	5	3	2
Essex	17	4	5	4	4	...

The small markets (handling under 5,000 head per annum) are apparently sporadically distributed, but a noticeable feature is the group of small markets in the south-center of Norfolk, while in Essex there is a marked concentration in the northwest boulder clay area. In the Norfolk and Suffolk Fens, there are no livestock markets, for the sales are concentrated in the large centers of Kings Lynn, Cambridge, and Bury St. Edmunds.

Of the markets handling over 10,000 head of stock per year, several have been established during recent years. Three of these lie in the east of Norfolk and four in eastern Essex. These new markets which have relatively large sales are evidently discharging important marketing functions that will be noted later.

As regards corn markets, Norfolk, Suffolk, and Essex, are among the greatest corn counties, and the Corn Exchange is a meeting place of farmer and merchant, maltster and miller. There is in Essex a marked concentration of sales in five towns—Chelmsford, Colchester, Romford, Braintree, and Saffron Walden. In Norfolk there is an overwhelming concentration of sales in Norwich, and relatively large sales at East Dereham and Fakenham. In Suffolk, the concentration is mainly at Ipswich, Bury, and for wheat, Sudbury. Bungay, Haverhill and Stowmarket are medium-sized wheat markets (40 to 70,000 cwts.) and Beccles, Halesworth, and Framlingham have annual barley sales of about 50,000 cwts. A number of small towns used to make government returns, but have either ceased to do so, or have negligible weekly sales (see Figure 1).

Owing to the development of railway transport, a corn market can now draw upon a wider area than in the pre-railway days—a healthy economic tendency, but one which is to the detriment of the small market. Farmers within a radius of 10 to 15 miles usually attend the market; maltsters, merchants and millers from within a radius of 25 to 40 miles. Hence the reason for the small markets noted above. Fakenham, for example, has the third biggest barley market in Norfolk. But the Corn Exchange has now been abandoned, for farmers are drifting towards Norwich and Kings Lynn. Sudbury suffers in the same way in favor of Bury St. Edmunds.

Eggs and poultry are sold at most markets in East Anglia in small quantities. In Norfolk, the number of ducks and turkeys is higher than any other county in England and Wales; these kinds of poultry are also numerous in Suffolk. Poultry keeping has increased greatly in northeast Essex in recent years. The chief egg and poultry markets are at Colchester, Wickford, Chelmsford, Braintree, Saffron Walden and Thorpe-le-Soken. It is estimated that at these six markets some 18 million eggs and 650,000 poultry were handled

in 1928. They supply the large consuming areas of Greater London and south Essex. At most of the poultry sales, eggs and dairy produce are sold; but the very important egg and poultry markets at Wickford and Thorpe-le-Soken should be particularly noted.

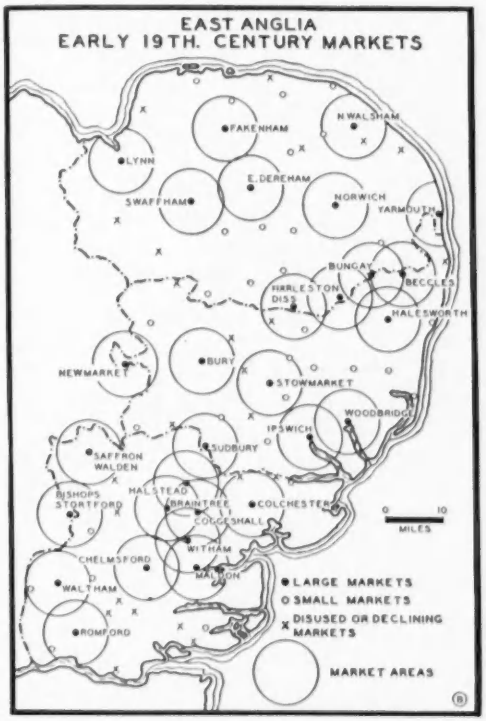

FIGURE 6.—Each of the large markets is given an arbitrary market area with a radius of six miles. This distance was the usual limit of a local market area before the advent of modern means of transportation.

SEASONAL FLUCTUATIONS OF LIVESTOCK SALES

The monthly sales of livestock at the East Anglian markets show marked seasonal fluctuations. The markets may be divided into several groups on the basis of these fluctuations, and correlations made with the types of rural economy found in the regions that they serve.

Stock fattening in East Anglia is generally associated with arable farming. Store cattle are imported from Ireland and the north of England, fattened, and then sold to dealers, ultimately reaching the butcher in London and the Midlands, in addition to supplying the local demand. In the summer months, however, the supply is insufficient to meet the local demand, and fat stock have to be imported from the Midland grass counties.

CATTLE

According to the seasonal fluctuations of their cattle sales, the markets may be divided into several distinct groups:

I. The typical markets of High Norfolk and Suffolk, for example Bury St. Edmunds, show fluctuations that would be expected from the type of husbandry. There is an output of fat cattle all the year round with a very marked peak from April to June, due to the sale of winter stall-fed bullocks. This is the normal curve where fat cattle only are handled, e.g., North Walsham, Fakenham, Sudbury, Wickham Market. Heavy supplies of store cattle appear at Bury St. Edmunds in April and May, when stores in forward condition are sold through dealers to graziers from the Norfolk marshes; and in autumn when North country and (to a decreasing extent) Irish stores are sold to farmers for wintering. The same features are apparent in the annual spring and autumn sales of store cattle at Swaffham, E. Harling and Attleborough, at which some 300–500 head are sold; and at Watton, E. Dereham, Fakenham, North Walsham, and Braintree. Norwich handles some 90,000 head per annum, 60,000 being stores. While weekly sales are more regular at this market, the same seasonal rhythm is evident, sales of North country and Irish stores being particularly large in the autumn months. The same régime is shown in Essex by Romford, Chelmsford and Colchester, but supplies are more regular.

FIGURE 7.—Totals of livestock include cattle, sheep, and pigs. Large periodical sheep fairs at Swaffham, Diss, East Harling, and Attleborough are excluded.

II. A group of small markets in east Norfolk handle fat cattle mainly during the first six months of the year (2–6,000 per annum): Loddon, Wroxham, Stalham, Aylesham. Acle receives most of its supplies of fat stock during this period, and comparatively few during the remainder of the year. Fat cattle grazed on the marshes during the summer months are marketed in Acle and Great Yarmouth and Norwich markets, so that their sales are not so markedly seasonal.

III. At most of the large markets there are fairly large sales of calves and milk cows, though not nearly so large as those of fat and store animals. But the overwhelming importance of dairying in the south of Essex and in the Essex marshes is evidenced by the large numbers of calves sold in the markets, with also a relatively large output of fat cattle and few store cattle.

IV. Herein lies the key to another group of small markets with distinct features. In the east Essex marsh area the markets handle negligible numbers of store cattle. Apart from milk cows and calves, fat cattle are their chief output. Here, the maximum sales of cattle, almost exclusively fat cattle, are transacted during the summer months. Thanks to the summer pastures, this area can put fat cattle on the market to supply the large floating population of the seaside resorts of east Essex, mainly Clacton and Southend. Stanford-le-Hope has such features, the largest supplies of cattle being marketed during the months of July, August, and September (40 per week) while the "shortest months" are February to May.

SHEEP

Three salient features should be noted as affecting the distribution and types of sheep sales.

I. The sales mainly exist to effect a transference of store sheep and lambs from the breeder to the grazier, and fat sheep and lambs to the butcher, i.e., there is little long range marketing.

II. Owing to the small number of sheep in the counties as compared with other parts of the country, the markets are necessarily few, and their sales relatively small, except in the largest central markets.

III. The seasonal fluctuations are conditioned by the fact that graziers replenish their flocks in the autumn and sell off in spring, while breeders, besides selling store hoggets in the spring, also sell large numbers of fat lambs after a short period of intensive feeding in spring and early summer. This type of farming gives rise to a large seasonal output in the principal sheep areas, of fat sheep and lambs, and a large seasonal de-

mand for stores, and, therefore, lends itself to sales through the medium of periodical fairs or special sales. It is also reflected in the seasonal rhythm of the markets, in some of which practically all the sheep are sold at seasonal sales. The largest markets, selling about 50,000 per annum, are Kings Lynn, Norwich, Ipswich and Bury St. Edmunds. The distribution of the medium sized markets, of seasonal sales (spring and autumn), and fairs, reflects the types of the rural economy, for these markets serve mainly the sheep area of northwest Norfolk, the light loam belt, and the maritime belt of Suffolk.

CONCLUSION

The largest livestock markets of East Anglia are Norwich, Kings Lynn, Ipswich, and Bury St. Edmunds, each handling over 100,000 head per annum, and a little over 40 per cent of the total sales of the three counties. Each serves an area of some 15–20 mile radius. Norwich (168,000) draws some 90 per cent of its supplies from Norfolk, except in the case of store cattle, which are drawn mainly from Ireland (85 per cent). With regard to distribution, 90 per cent of the imported store cattle are bought by the Norfolk farmers. Dairy cows, sheep, and lambs are almost exclusively distributed within the county. Fat cattle and pigs are dispatched to London or the Midlands.

Detailed investigation of the market areas indicates that, though the markets, relative to other areas of England and Wales, are few and well distributed, there are many which are superfluous, whose areas are adequately served by neighboring larger markets. It is one of the main aims of the Ministry of Agriculture to foster the concentration of marketing in fewer large markets. In High Norfolk, East Dereham, Watton, Fakenham, Diss, Reepham, and Harleston, are the only markets handling over 10,000 stock per annum. In east Norfolk the medium sized markets serve areas of some four miles radius, as compared with eight miles common to the markets of the western half of the county. In the latter area, the sales are mainly of sheep; in the former, of fat cattle. This partly explains the variation in extent of their market areas.

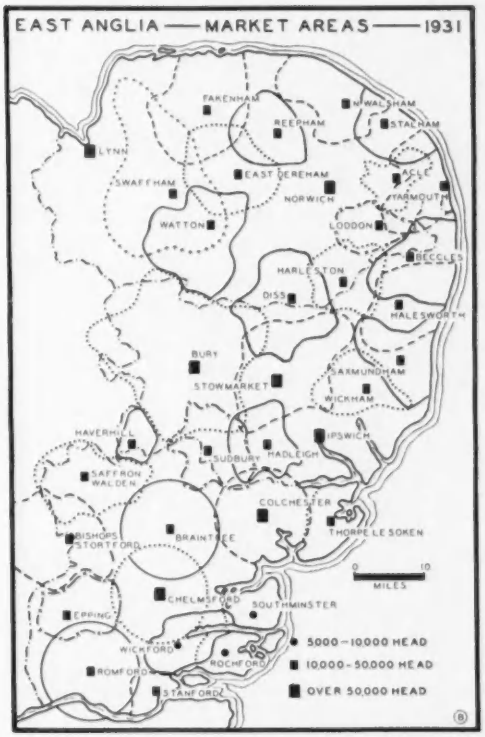

FIGURE 8.—Market areas of East Anglia in 1931, based on information obtained from auctioneers. In several cases where the actual area could not be obtained, circles with an eight mile radius have been drawn, within which most of the local marketing takes place. In order not to complicate the map, the market areas of the chief markets are not directly shown, but their main areas may be inferred. The line of plus signs incloses the area served by the seasonal sheep sales at Swaffham.

In High Suffolk, several markets handle pigs almost to the exclusion of cattle and sheep; in fact, these markets serve the most intensive area of pig production in England, and the stock are sold over short distances to near markets.

In Essex the most marked feature is

the concentration of sales at Colchester, Chelmsford, and Romford. Braintree, Epping, Saffron Walden, and Bishops Stortford, are the only markets in north-west Essex handling over 10,000 stock per annum, and, given arbitrary, though approximately correct, market areas of eight miles radius, they more than adequately serve the whole of this area, in which there are located a number of very small markets. In east Essex as in east Norfolk, there is a group of recent markets, which have already been specially noted on several occasions, with small but well defined market areas, which mainly supply the needs of the coastal resorts.

It will be evident from the foregoing study of the distribution and size of markets, that with the development of transport and modern organization, marketing activities show a tendency to concentrate in fewer centers. The distribution of mediaeval markets was such that all places were within two to four miles of one or more markets. In the early nineteenth century the larger market towns, at points of greater nodality, were located at ten to fifteen mile intervals. In recent years, there has been an increasing tendency to the further concentration of marketing activities in even fewer centers, now rendered easily accessible by both rail and road.

FURNITURE INDUSTRY OF THE SOUTHERN APPALACHIAN PIEDMONT

Ben F. Lemert

THE furniture industry of the Southern Appalachian Piedmont is located in the central portion of the Piedmont section of North Carolina and extends into the southwestern Piedmont of Virginia. This furniture development produces more bedroom and dining room furniture than any other section of the United States, North Carolina ranking first in the production of wooden dining room and bedroom furniture, and second in wooden kitchen furniture. In the country's total production of wooden household furniture North Carolina ranks fifth, while in the production of all types of furniture it is exceeded only by New York, Illinois, Michigan, Indiana and Ohio. Furniture is manufactured in all of the South Atlantic States, but nowhere has it reached the high stage of development attained in the central portion of the Southern Appalachian Piedmont (Figures 1, 2, and 3).

History

The manufacture of furniture in North Carolina began about 1888, during the time when the so-called Industrial Revolution of the South was just getting under way. The city of High Point, a few miles southeast of Winston-Salem, was the site of the first furniture factory, an undertaking fostered by a few local men. High Point is still the center of Southern furniture manufacture and is one of the country's important furniture markets.

Prior to the Industrial Revolution in the South, southern people purchased most of their manufactured goods from the North, and furniture was no exception. It was either purchased from the North or made in the home. The first Piedmont furniture factories sought to capture the Southern market, especially that section that purchased cheaply made goods. It was fortunate for the new industry that there was such a market available. It could not have hoped to compete with the older furniture industries of the North in the production of manufactured goods of high quality. Due to proximity of raw materials, abundance of cheap labor anxious to learn, and aided by the improving transportation systems of the South, the local industry did capture the market for cheap household furniture.

Although the Piedmont furniture industry did not seek other markets than its Southern field prior to 1921, the Southern market must have been fairly lucrative. The industry of North Carolina, during the period 1888–1919 increased its total output from nothing annually, to $29,768,623 (Figure 4). This total represented cheap oak furniture. Piedmont furniture totals might still be representing cheap oak furniture and still gradually increasing in amount had not a sudden change become necessary during the depression of 1921. The total farm value of cotton, which in 1919 stood at $2,034,658,000, dropped in 1921 to $634,000,000. The buying power of the Southern customer was practically wiped out. The furniture market on which the Piedmont furniture industry had depended for thirty years,

disappeared. If the furniture factories were to continue operations they had to seek a new market. This was their first experience in competing with the older Northern furniture producers in a market which, up to that time, had been almost the same as foreign. When Piedmont furniture manufacturers sought to sell their wares in New York, their products were ridiculed. Northern styles had changed and had always been far superior to those of the Southern producer.

It may have been sheer desperation, or it may have been the initiative of a relatively new industrial section that survived the difficulties. The Piedmont manufacturers procured designs of Northern furniture and of the period furniture that was coming in style. Their employees were no longer unskilled cabinet makers. Thirty years' experience enabled the Piedmont manufacturers to copy the new types of furniture, and perhaps Scotch-Irish common sense caused them to refrain from trying to produce the highest type furniture. They settled upon reproductions of the highest type in a medium price grade. This opened to them the larger strata of the new market into which they were venturing and promised a better chance

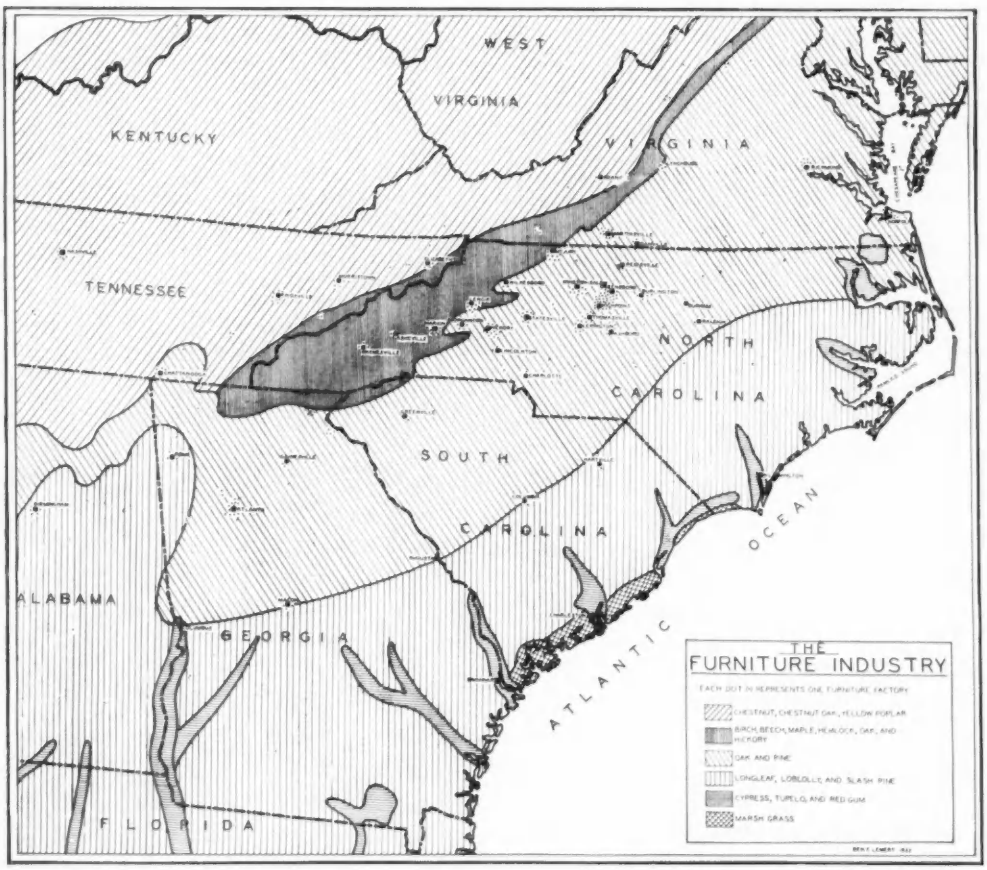

FIGURE 1.—The Piedmont furniture industry in its setting amidst the principal forest associations that are tributary to it and which are one of the main factors in its establishment. (Forest Associations after Natural Vegetation Map, H. L. Shantz and R. Zon.)

to sell more goods once they were able to pierce the market.

The experiment was successful. Whereas the Piedmont furniture industry had experienced a gradual but steady growth over the previous thirty years, the next ten years saw it increase its volume by almost 100 per cent (Figure 5). What had appeared a disaster was turned into good fortune. Where the market had been limited to the South, the years following 1921 saw Piedmont-manufactured furniture being sold throughout the United States. Furniture factories began to multiply in North Carolina. An immense exhibition building was built in High Point to which buyers from throughout the country came, and still come, twice a year to select Piedmont products. The industry spread up into the southwestern Piedmont counties of Virginia, and these factories, being even younger and more energetic than the older industry in North Carolina, were quick to adopt all possible improvements. The Virginia industry, which had languished in the older sections prior to 1919, increased 460 per cent in the next decade with Martinsville and Bassett as its centers (Figure 5). To-day large furniture companies of the Piedmont own and operate their own forests, replanting as they cut. They carry on all the stages of manufacture from the time the log reaches their factories until it slides out into the waiting cars as finished furniture. Many factories, dependent and independent of the furniture industry have grouped themselves around the Piedmont industry. The market has continually widened until a citizen sitting at a desk or reclining in a chair anywhere in North America, Cuba, South America, Egypt, South Africa, or Australia should not be surprised if he finds the furniture equipped with the label "Made in the Piedmont Carolinas."

ADVANTAGES OF LOCATION

Geographic influences favoring the furniture industry of the Southern Appalachian Piedmont far outweigh influences that might affect the industry adversely. Climate, topography and soil make possible a species of land utilization that produces a continuous

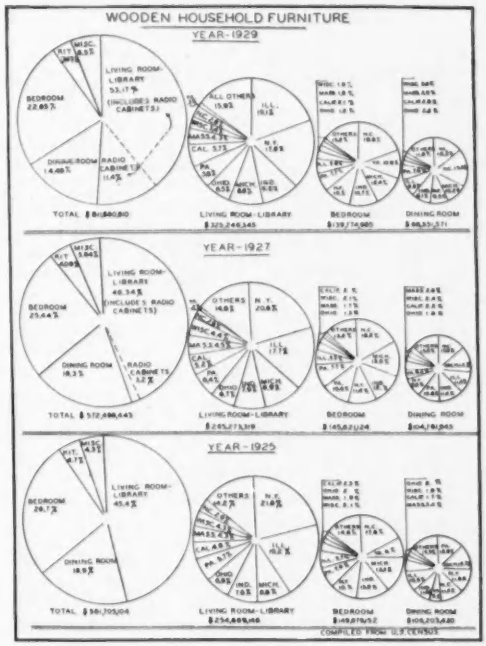

FIGURE 2.—A comparison of various types of furniture manufacture and the relative proportion produced in each of the principal furniture manufacturing states in alternate years 1925 to 1929. Note the increase of North Carolina and Virginia in percentage of total production of bedroom and dining room furniture.

and abundant supply of cheap labor. Climate and topography are likewise responsible for the abundant supply of raw material in the form of lumber, and climate and topography, adapted to the needs of intelligent human beings, produces abundant hydro-electric power throughout the region. The location of the industry and the topography of the surrounding region make available the enormous coal fields of the Cumberland and Allegheny Plateaus. Topography

made possible the building of the Southern Railway and interconnecting lines, while location within a short distance of Norfolk provides easy access to transportation by water. The location of the industry assures its dominance in the Southern market, while at the same time it is near enough to the Northern market to allow its competing in the Northern field, and both Northern and Southern manufacturers compete on relatively equal terms in the West.

Disadvantages of the region are few and of minor consequence. Hundreds of thousands of pieces of hardware must be shipped into the Piedmont region from New England. Much wood-working machinery must still be purchased in the machinery manufacturing sections of the North. Some paints and varnishes must still be purchased from the same region and this is also true of veneers and imported hardwoods. However, factories for the manufacture of wood-working machinery are springing up in the South, paint and varnish factories are seeking locations near the furniture plants and already furnishing much of that industry's needs. Imported woods still come from New York and New Orleans, but veneers are more and more being made in the plants and close to the plants where they are used. Southern furniture manufacturers say they can obtain hardware cheaper by buying it in New England than by manufacturing it in the South. Time, and the extent of the future development of the Piedmont furniture industry will determine whether this type of manufacture will also seek its midst.

LABOR

Labor is the chief advantage of the Southern manufacturer. This advantage lies within three categories—it is cheap, it is abundant, and it can be trained to operate complex machines efficiently. A fourth advantage might be stated—dependability. Southern labor is dependable for the most part when not subjected to influences foreign to its inherent characteristics.

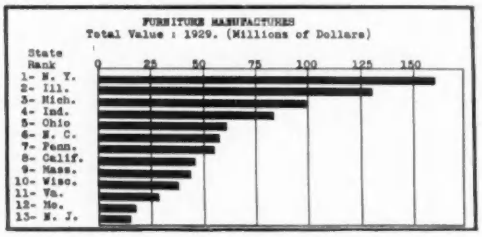

FIGURE 3.—These totals include furniture of wood, metal, fiber, reed, rattan, and willow, and include four classes of manufacture, namely household, office and store, professional (laboratory, hospital, and so forth), and public building furniture.

Geographic influences are responsible for the abundance of the supply of labor. The Piedmont furniture factory is located in the transition zone of North Carolina and southern Virginia, its northern extension lying within the tobacco belt while its southern extension protrudes into the counties of North Carolina where cotton growing dominates agriculture. Throughout the region the growing season is from 190 to 200 days in length. The topography, for the most part, consists of smoothly rounded hills. The farms are small and the farmers either raise corn and tobacco or cotton and corn. The corn is for subsistence of man and beast while the cotton and tobacco are for sale, and the price they bring depends upon the world market for cotton, the prices offered by the concentrated tobacco industry, vicissitudes of climate, the activities of insects, and the extent of plant diseases. If crops are good seldom does anyone make very much money. If crops are poor a few lucky enough to have an average crop may make some money while the majority suffer. In ordinary times the farmer makes just enough to pay his debts and start the year with a clean slate.

If everything goes all right he can do this, but seldom do things turn out that way. The crop is usually mortgaged ahead and two or three bad years mean foreclosure. The farmer becomes a tenant on land that was his own. Many of the farmers have never owned land, but rent it. This is possible because of the nature of the agriculture. A farmer with his family can scarcely take care of more than twenty or thirty acres of cotton or tobacco. Thus, one man may own one hundred acres and rent out parts of his farm to different tenants. Some men own thousands of acres and rent them to many different tenants.

In a region where the growing season is from 190 to 200 days long the soil has little rest from leaching and the soils of the Piedmont, consisting of sandy clay loams and clay loams, have been leached for centuries. Their redeeming feature is good structure, which takes fertilizer well, but it takes a pound or more of fertilizer to produce a pound of cotton or tobacco. Fertilizer costs, from which the crop returns are very speculative, and crops that require so much attention that little time is left for the growing of subsistence crops, leave the farmer in an extremely hazardous position, and his lot is usually a hard one. Poor people who work hard with little time for education are prone to produce large families. The birth rates of North Carolina and Virginia show these states to be no exceptions to the rule. The children of these families grow up amidst hard living conditions. They see the possibilities of escape from this type of life by going into mill work, and if the furniture factory, the textile mill, or the tobacco plant do not get the parents sooner or later, some of the children are bound to become factory hands.

Another region close to the furniture factory produces hands, not because of the one crop agriculture, but because of topography. To the west of the furniture manufacturing region are the Blue Ridge mountains. In the mountains the valleys are narrow and the slopes are steep. The farmers live along the valleys and till the slopes as high as they are cultivable. Farms a mile long and a few feet wide, with poor transportation for products will not support many people. The children of the mountaineer

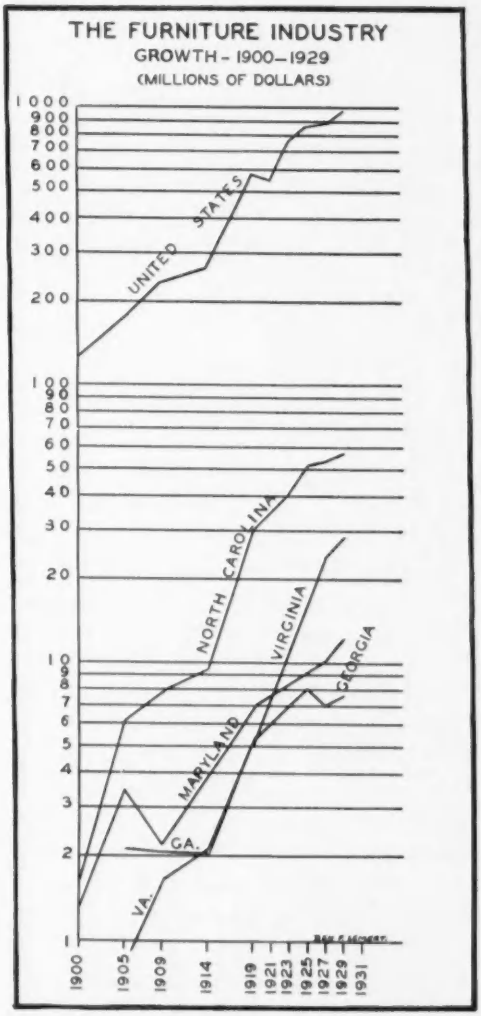

FIGURE 4.—The rise in value of manufactured furniture in each of the four states of the Piedmont section from below two million dollars in 1900 to over seven million dollars in 1929, and to over fifty million dollars in North Carolina by the same date, is indicative of the strides that the Piedmont furniture industry has made in thirty years.

must seek the lowlands for means of subsistence, for the land cannot be indefinitely divided. Often the lot of the mountain farmer is so difficult he must follow his children to the lower hill country and the mills are the recipients of the labor supply thus produced.

The average wages of the North Carolina furniture worker were $821 annually, in 1929, while those of Virginia furniture employees averaged $845. At the same time wages of furniture workers in New York averaged $1,647; in Illinois, $1,378; in Indiana, $1,086; in Michigan, $1,332; and in Ohio, $1,314. The wages of the Piedmont worker were lower and are lower to-day because farm labor and common labor receive lower wages in the South than in the North. In normal times there is a greater demand for labor in the large manufacturing districts of the North than in the more scattered and less highly developed districts of the South. The third reason for lower wages in the Piedmont is that living costs of the laboring class are almost without exception lower than in the North.

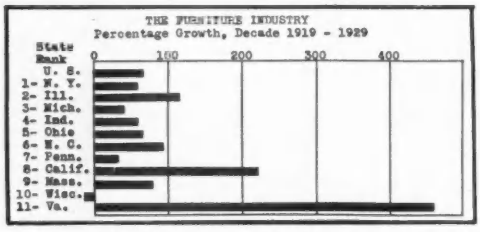

FIGURE 5.—It is interesting to note the rapid growth of Virginia's furniture industry in a period of ten years and the decrease of Wisconsin's production.

The Southern laborer lives in a region where light-weight clothing can be worn throughout the year. If he needs an overcoat for winter, it is a light affair, and in February of 1933 clothing costs were higher in New York, Trenton, Philadelphia, and Baltimore, than in the Piedmont Carolinas. As for food costs the Piedmont worker for the most part comes from an ancestry that subsisted on fat back, corn bread, bacon, beans, and molasses. He can subsist on such fare indefinitely if necessary. Meat is cheaper in the South than in the North although packing house men say it is not as good. Butter and milk are slightly higher, while canned goods and vegetables are about the same price. If the worker purchased wheat bread at the bakery he would undoubtedly pay slightly more than in the North, but he eats and prefers hot biscuits of which a serving for a large family can be made from three or four cents worth of flour and a little water. If the Piedmont worker should eat what the ordinary Northern family consumes his costs would be less, even were he to live in the largest Southern cities. Costs of such fruits as bananas, oranges, and grapefruit are ridiculously low.

Most Southern people live in houses while city workers of the North tend to occupy apartments. Rents for houses for workmen are low in the South, heating expenses are far lower than in the North, while lights and water are approximately the same.

The wages of the Piedmont furniture worker can be lower than those of Northern furniture employees because of lower living costs. They are lower because farm labor and common labor wages are much lower; and these wages are much lower than those for similar occupations in the North due to the fact that a great black laboring force has always done the hard labor of the South and is willing to do so and ofttimes do it better for less wages than those paid the white man. If the furniture worker does not like his work he cannot do better in a textile mill, nor in a tobacco factory. He dreads to return to the hard and poorly paid agricultural labor from which he himself or his parents

came. He could move northward, but Southern labor is still conservative, it does not like the long, cold, northern winters, and it does not like the crowded northern industrial districts.

The average wage of the Piedmont furniture worker is much lower than that of the northern furniture worker, also, because of the small amount of skilled labor required. In the South the factory worker for the most part is unskilled. In the tobacco factories machines do the work. In the spinning and weaving sheds vast numbers of machines are busy fabricating the cotton and the workman is conspicuous because of the large number of automatic machines he is able to attend. The furniture industry is likewise an industry of automatics.

The Southern Piedmont furniture industry produces medium priced furniture the chief constituent of which is wood. The industry is new. New industries are quick to adopt new ideas and new equipment. The chief products are bedroom, dining room, and kitchen furniture, produced by mass production methods. In such a system of manufacture much automatic machinery can be used, and wherever a machine can replace a man it is set up. Thus the machines can be set to produce a given style of table, chair, bed or dresser and thousands of similar parts can be turned out without readjustment of the machines. The initial processes are planing mill processes. In the cutting out of the forms workmen either lay the board in the machine and take out the cut product, or the machine may feed itself with pieces of lumber, turning out table legs like sausages from a mill. In such a type of manufacture even most of the carving is done by machines while the cabinet makers who put the pieces of furniture together are the most highly skilled and highly paid workers in the plant. Southern mills doubtlessly can produce expensive furniture, for many of their employees are a generation removed from the farm. However, expensive furniture requires much time and higher skill. Time and skill demand higher wages. Fewer such products can be produced in a given time and the market for them is narrower.

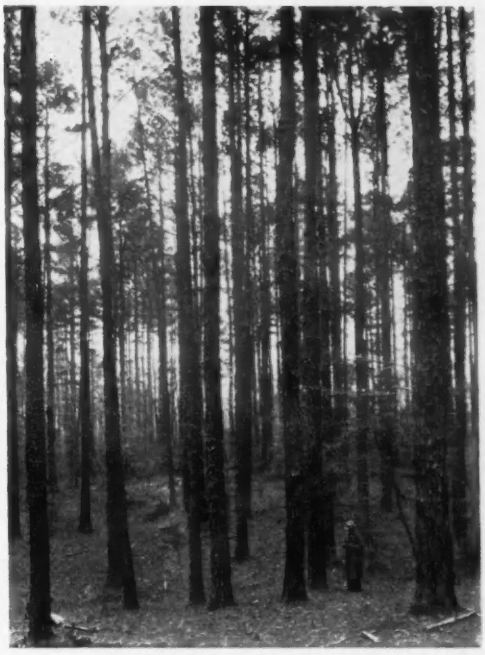

FIGURE 6.—A stand of southern yellow pine, the typical forest of the Atlantic Coastal Plain, within close range of the Piedmont furniture industry. (Courtesy Duke Forestry Department.)

The furniture industry of the Piedmont is located in the midst of the textile industry. While furniture manufacture is a man's job and few women find places in it, the textile industry employs much female labor. Wherever a furniture factory exists sooner or later cotton mills and knitting mills are built around it. The head of a family with his grown sons works in the furniture factory; the wife and her grown daughters are employed in the textile mills. Such a correlation of labor tends to stabilize the employment situation for both types of industries. If the males of the family

were desirous of quitting their work, the females may be satisfied and the family remains engaged in production. Since the standard of living of the family is based upon the combined incomes of its members, they are less likely to do anything that will disturb the situation.

Agitators find it more difficult to foment strikes in such industrial communities. In the furniture region of the Piedmont they must agitate disturbances in not only the furniture, but also in the knitting, cotton, and silk industries simultaneously in order to have a chance of winning. Such a general strike was carried out in 1932 in the Piedmont furniture district, but, like most strikes of Southern workers, it failed. In spite of the momentary solidarity of such labor uprisings, the inherent conservatism of the Southern worker, but recently from of Northern factories due to the fact that Piedmont furniture factories are newer and the industry is not burdened with old, badly lighted, and poorly ventilated buildings.

In 1929 the average wage rate for North Carolina, the largest Southern furniture manufacturing state, was 33.3 cents as against 55.5 cents for Michigan, 47.4 cents for Pennsylvania, 48.6 cents for Massachusetts, and 56.6 cents for New York, making the wage differentials over North Carolina, 22.2, 14.1, 15.3, and 23.3 cents respectively. North Carolina was 16.6 cents below the average of the United States which was 49.9 cents.

August 1, 1933, Southern furniture manufacturers signed the President's Reëmployment Agreement and immediately put into effect a minimum wage

TABLE I

FURNITURE

Consumption of Wood in Manufacture, 1929

	Lumber					
	Total		Hardwood		Softwood	
State	M. ft. b. m.*	Cost	M. ft. b. m.	Cost	M. ft. b. m.	Cost
North Carolina	192,032	$7,832,468	174,039	$7,436,190	17,993	$396,278
Virginia	101,276	4,213,287	90,474	3,907,311	10,802	305,976
New York	165,655	11,889,168	116,298	9,582,333	49,357	2,306,835
Michigan	156,224	8,630,986	115,548	7,235,840	40,676	1,395,146
Illinois	127,772	9,285,748	100,981	8,245,929	26,791	1,039,819
Indiana	191,381	8,779,859	136,840	7,172,129	54,541	1,607,730
Ohio	70,935	3,862,270	46,676	2,911,578	24,259	950,692

Source of data: U. S. Census of Manufacturers 1929.
* Thousand feet board measurement.

an agriculture in which his lot was far worse than that which he undergoes in manufacturing industries, and perhaps his Scotch-Irish common sense, prevent his permanent alliance with disturbing influences.

In addition to paying his workmen lower wages, the Southern Appalachian Piedmont furniture manufacturer, prior to August first, 1933, worked his men longer hours than did similar manufacturers in the North. The Piedmont furniture worker was employed from 50 to 55 hours weekly and the 55-hour week was common. Working conditions are as good, if not better than those rate of 30 cents per hour with 40 hours maximum for a week's work. The Northern wage minimum was set at 34 cents per hour with 40 hours per week maximum. This procedure is contained in the Code approved December 7, effective December 11, 1933.

The results of the NIRA practices as seen in the Southern furniture field are: (1) an average wage 67 per cent higher than in June, 1933 (in some instances it amounts to a 300 per cent increase); (2) a 27 per cent reduction in hours; (3) almost a 6 per cent increase in number of employees over that of July, 1929 (Sixty-seven representative

Southern furniture plants reported total employment, 11,500, July 1929; 12,179, August 1933, an increase of 679 workers, or 5.9 per cent); (4) a cutting of the Southern wage advantage from 17.6 cents (average for Ga., N. C., Va. and Tenn.) to 4 cents; and (5) wiped out entirely the Southern hours-employed advantage.

The Southern Appalachian Piedmont furniture industry has long enjoyed a cheap-labor-long-hours advantage. It has long undergone somewhat of a disadvantage in freight rates. It is close to its raw materials, but the Lumber Code has increased the cost of this item. The rapid growth of the industry in the Piedmont led to signs of overproduction as early as 1927, signs which became more ominous as the depression settled over the country. The industry in the past few years has been like the farmer with his tobacco—the lower the price the more he produced in order to maintain a fixed income.

There is no doubt but that the industry is admirably located in a region which promises continuously abundant labor and which also promises to be the country's future lumber cropping area. The industry, as it exists to-day, is badly disorganized, like a group at a bargain counter—all grabbing and few getting much or what they should have. The industry will persist, but if it is to reach higher stages of development it must have organization, which amounts to either coöperation in the form of combination, or control by an industrial czar who can survey the field, eliminate weak spots and practices, and strengthen sections that are promising.

TABLE II

FURNITURE

Lumber Consumption—Average Cost per M. ft. b. m., 1929

State	*Total*	*Hardwood*	*Softwood*	*Total Cost of Veneers and Plywood*
North Carolina	$40.78	$42.72	$22.03	$3,745,684
Virginia	41.60	43.18	28.32	1,460,464
New York	71.77	82.39	46.74	3,963,566
Michigan	55.24	62.62	34.29	4,631,291
Illinois	72.68	81.65	38.81	8,841,222
Indiana	45.87	52.41	29.47	6,530,852
Ohio	54.44	64.52	39.19	946,470

Calculated from U. S. Census of Manufacturers 1929.

RAW MATERIALS

The Piedmont furniture industry is located in the midst of a forested region, the Piedmont being covered with trees of pine and oak. To the west are the Blue Ridge mountains and the Appalachian plateaus, covered with oak, chestnut, yellow poplar, maple, and many other hardwoods. In the Coastal Plain are the gums and the cypress. During the initial stages of the furniture industry in this region oak was the chief lumber used, and is still an important item in furniture manufacture. At the present time much of the lumber is shipped in from other states. The hardwoods come from the Appalachian Plateau, with the exception of gums, a large portion of which are brought to the Piedmont from the lower Mississippi Valley. Red gum is the chief type of this timber utilized in the industry (Table III).

The Piedmont furniture industry uses more wood than any other furniture manufacturing section in the United States because its production is principally wooden household furniture such as bedroom, dining room, and kitchen suites. Such furniture consists for the most part of solid wood with little added materials. Of its total value of production in 1929, but $3,556,153 out of $53,414,111 worth of wooden household

TABLE III

LUMBER PRODUCTION—SOUTHERN STATES

(Lumber Sawed—M. feet b. m.)

HARDWOODS

State	Chestnut	Hickory	Maple	Oak	Red Gum	Tupelo	Yellow Poplar	Walnut
Delaware	.....	113	.....	2,030	106	.....	.....	.....
Maryland	1,953	432	2,142	15,620	1,624	220	189	66
Virginia	32,227	1,337	5,362	161,934	10,674	1,602	36,602	716
West Virginia	111,224	6,242	57,891	208,739	1,105	735	73,226	3,182
Kentucky	13,649	3,887	6,801	210,709	6,428	476	34,963	5,460
Tennessee	31,514	12,841	19,442	342,940	79,011	2,703	75,078	5,784
North Carolina	44,980	1,478	10,058	118,731	30,168	17,674	25,503	153
South Carolina	.....	648	9,940	29,231	80,647	29,318	20,955	1,504
Georgia	1,360	610	3,270	47,245	61,240	9,862	56,441	88
Florida	.....	798	12,026	35,268	20,140	.....	13,232	.....
Alabama	150	3,243	828	110,558	88,449	20,911	46,030	196
Mississippi	.....	4,497	8,216	173,219	181,557	23,610	31,585	.....
Louisiana	.....	3,136	584	271,168	269,090	132,267	8,858	.....

SOFTWOODS

State	Cedar	Cypress	Hemlock	Spruce	White Pine	Yellow Pine
Delaware	.....	.....	.....	.....	.....	7,301
Maryland	.....	120	.....	.....	886	30,488
Virginia	269	1,259	11,155	333	6,418	428,545
West Virginia	.....	.....	58,133	54,135	2,673	5,986
Kentucky	2,204	1,940	5,585	.....	2,491	15,592
Tennessee	5,026	6,752	19,306	.....	7,138	77,096
North Carolina	5,478	24,001	12,675	6,769	4,427	885,874
South Carolina	798	58,398	.....	.....	.....	818,625
Georgia	.....	23,095	436	.....	.....	1,165,527
Florida	.....	187,939	.....	.....	.....	840,449
Alabama	3,436	5,066	.....	.....	.....	1,761,206
Mississippi	.....	29,896	.....	.....	.....	2,144,295
Louisiana	.....	111,739	.....	.....	.....	1,306,295

Source of data: Census of Manufactures of the U. S. 1929.

furniture represented living room and library suites (Table I and Figure 2).

Although the Piedmont does use more lumber than any other American furniture manufacturing section, it pays less per thousand feet board measurement than any other section. In 1929 the average cost in North Carolina for all lumber used in furniture manufacturing per thousand feet, board measurement, was $40.78. The figure for Virginia stood at $41.60 while Illinois paid the highest price, or $72.68. The cost of hardwood lumber to the Piedmont manufacturer was relatively proportional to these costs. During 1929 the North Carolina furniture producer paid an average of $42.72 per M. ft. b. m.; the Virginia producer, $43.18 per M. ft. b. m.; and the New York manufacturer, $82.39. With reference to softwoods, North Carolina's cost was $22.03 per M. ft. b. m.; Virginia's $28.32, and New York's, $46.75 (Table II).

The Piedmont manufacturer pays less for his lumber because he is relatively close to supply, and transportation facilities are good. Much of the lumber is obtainable at lower prices because the labor used in producing the lumber is paid the common labor wage of the South, a wage that was 26 and 27 cents an hour as compared with 40 and 43 cents an hour in the East North Central and Middle Atlantic States, respectively, in 1929. A third reason for the cheapness of the Piedmont furniture manufacturer's lumber is the fact that throughout the Piedmont, the Coastal Plain, and the Blue Ridge, the farmers maintain wood lots from which they cut lumber during their spare time. This lumber they haul to local furniture factories and planing mills. Local saw mill companies likewise sell to the furniture plants and the prices for such locally produced lumber tend to hold down the prices of lumber that is sold to the mills from without the state. A common sight in any of the larger furniture man-

FIGURE 7.—Typical homes of furniture workers, High Point, North Carolina, lending more individuality and independence to the Southern mill worker than the tenement structures of the North permit to the Northern laborer.

ufacturing cities of the Piedmont is the farmer bringing his load of lumber to the mills and his haggling with the foreman for a satisfactory price.

Many of the larger furniture companies of the Piedmont own their own forests, maintain them scientifically, cut their lumber like a crop, and thus cut out the middle men, at the same time assuring themselves a permanent supply. Such factories will not even buy of local producers, insisting they can produce their own lumber cheaper.

FUEL AND POWER

A large number of the Piedmont furniture factories buy their power while others generate their own by the utilization of waste products supplemented by coal.

Just across the Blue Ridge west of the Piedmont furniture region is the southern section of the largest bituminous coal field in the world. The Blue Ridge is not an impassable mountain chain, but is pierced by James River west of Lynchburg, and by Staunton River at Roanoke, Virginia. Gaps are also found in North Carolina, such as the Nantahala Gorge, French Broad River, and the route followed by Clinch River and Ohio Railroad. Long lines of coal-laden cars continually pass through these openings and up around the lower end of the Appalachians via the Southern Railway, bringing steam coal and domestic fuel into the Piedmont where it sells as cheaply as it does in New York, Ohio, or Illinois.

Some of the better-equipped furniture factories do not use coal. They produce their own lumber in their own forests. The logs are cut in short lengths and brought to the factory where they are cut into veneers and plywood. Each veneer log has a large inner portion that cannot be cut for the veneer. This portion is further trimmed for packing material, and the residue goes to the boilers along with the sawdust from the mill. The slabs are fed into the furnaces while the sawdust is blown in, similar to the manner of feeding powdered coal to a furnace. The waste of the manufacturing processes thus furnishes steam for softening processes, heat for drying, and power for machinery.

FIGURE 8.—Common throughout the Piedmont is the association of short-leaf pine, oak, and hickory. (Courtesy Duke Forestry Department.)

Those plants buying their power can obtain it as cheaply and, in some in-

stances, cheaper than it can be obtained in the North, for the Piedmont furniture industry is located in the midst of one of America's great hydro-electric power developments. During the winter the winds are drawn in from the Gulf and the south Atlantic because of the passage of cyclonic storms, and in the summer they flow into the great low pressure area of the interior from the same regions. These winds, bearing much water vapor, rise over the Piedmont where they drop 45 to 55 inches of rainfall annually. From the Piedmont they ascend to the mile-high peaks of the Blue Ridge where the precipitation in many instances exceeds 80 inches annually. The water thus precipitated rushes down through the gorges of the Blue Ridge and out over the crystalline rocks of the Piedmont cutting deeper and deeper channels as the Fall Line is approached. In the gorges man has built dams where he catches the water again and again ere it reaches the gently sloping Coastal Plain. At each dam he guides the escaping water through penstocks where its weight is concentrated to drive the wheels of turbines, generating electric current. This electromotive force is transmitted through copper and aluminum cables to the factories of the Piedmont where it turns the wheels of machinery that rolls the cigarets by the billion, weaves hundreds of millions of yards of cloth, and cuts out and shapes thousands of pieces of furniture.

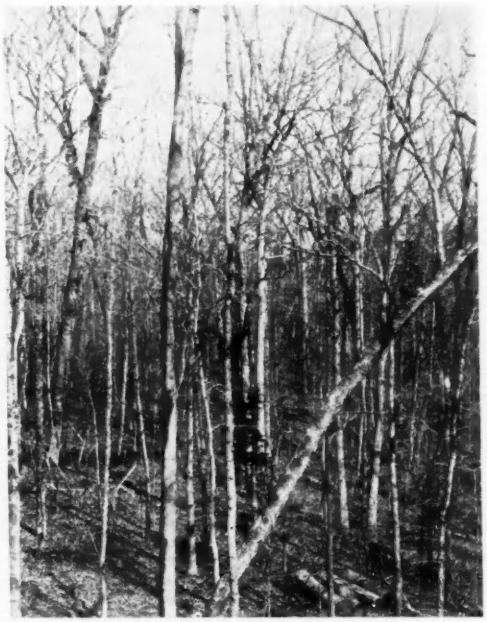

FIGURE 9.—The source of much of the Piedmont's furniture, the white oak, red oak, and hickory association of the southern Appalachian forest. (Courtesy Duke Forestry Department.)

TRANSPORTATION

The Piedmont furniture industry is located in the smoother portion of the Piedmont, that section which extends along the eastern edge of the Blue Ridge from Atlanta, Georgia, to the Potomac and beyond. During the katamorphic processes of the past the great mountain mass known as Appalachia was worn down to a peneplain, from the Blue Ridge portion to the sea. Streams cutting their way out of the western mountains had established their courses across the plain. The last anamorphic process resulted in the uplifting and further tilting of the section now known as the Piedmont, and these streams again began incising their channels, this time cutting from the edge of the Piedmont or the Fall Line, back towards the mountains. The result was a stretch of smoother land close to the Blue Ridge, land that has not yet felt the full erosive forces of the streams. From Atlanta northward through this portion, the Southern Railway proceeds on its way to Washington and the North. Many branch lines extend outward to the east, and westward through the rougher land, connecting with other north and south routes and with trunk routes of the great railroads of the Mississippi Valley. At Lynchburg, Virginia, this railroad crosses two other trunk line routes

running from Virginia's tidewater to the Middlewest.

It is along the Southern Railroad that most of the furniture factories cluster, while others are located along its branches. Such location affords the industry a direct route to the large market of the South, and as direct a route to the consuming centers of the Northeast, while the cross connecting lines provide efficient transportation to the tidewater and to the Middlewest and beyond.

The central city of the furniture industry, High Point, North Carolina, even has its own locally owned railroad, the High Point, Thomasville, and Denton Railroad. This line, while claiming to be the most efficiently operated and prosperous railroad in the United States, provides direct connections between furniture factories, the Southern Railroad, and other direct routes out of the furniture district, thereby saving furniture shippers much valuable time in their shipments.

The Piedmont furniture industry ships its products to all sections of the United States by rail. It is close to tidewater and the port of Norfolk, where many carloads of furniture manufactured in the Piedmont are shipped to the Pacific Coast via the Panama Canal at a saving of approximately $100 per carload in carrying charges when compared with the cross-country rail haul. In addition to these methods of transportation, the furniture industry is located in a region of excellent highways over which move continuous lines of trucks operated as systematically as any line of transportation in the country. A common sight on Piedmont roads is a line of trucks jammed with furniture, some going to New York, some to New Orleans, and others to Norfolk or Miami. These trucks pick up their shipments at scheduled times directly from the factory. From the time they leave the factory they are in continuous motion until they draw up beside the unloading platform of the consignee. Such handling provides convenience both for the shipper and the buyer, saves days in time of shipment, and costs no more than rail transportation.

MARKETS

Since 1920, Piedmont furniture producers have been reaching farther and farther into the markets of the world. The South has been their market from the inception of the industry and continues to be so, for the grade of furniture, proximity, and price assure them of this market. They are at a disadvantage in respect to distance when they sell in the Northeastern and North Cen-

FIGURE 10.—Twenty-five years ago this plant served one of the leading High Point furniture manufacturers. Note that the factory was enlarged three times before it was abandoned. (Courtesy High Point Chamber of Commerce.)

tral markets but they do sell in those markets for the same reason that Bedford, Virginia, tomato canners sell carloads of canned tomatoes in Columbus, Ohio, a city close to the canning factories of Troy and Tippecanoe City. They can produce the goods cheaper here than can be done in the North, and cheap, efficient labor, cheaper raw materials, and perhaps greater efficiency in a newer industrial region with its newer equipment, are the preponderant factors supporting their actions. With reference to other American and world markets they are on a par with other American furniture producing sections, and in some instances a little above parity. Quite a bit of Piedmont furniture is sold in the West Indies moving via Miami and via Norfolk. That which is sold in South Africa, Egypt, or Europe likely seeks New York as its port due to better sailings. Such procedure would not give the South much advantage over Northern sections in transportation. Furniture sold in Australia goes via the Panama Canal and enjoys better transportation facilities than are afforded furniture producers of the interior of the country. However, California's furniture industry is progressing and may annul any transportation advantage in that portion of the world. Such is possible, yet Piedmont furniture is sold by the carload in California, Washington, and Oregon and, here again, such possibility must be due to difference in production costs.

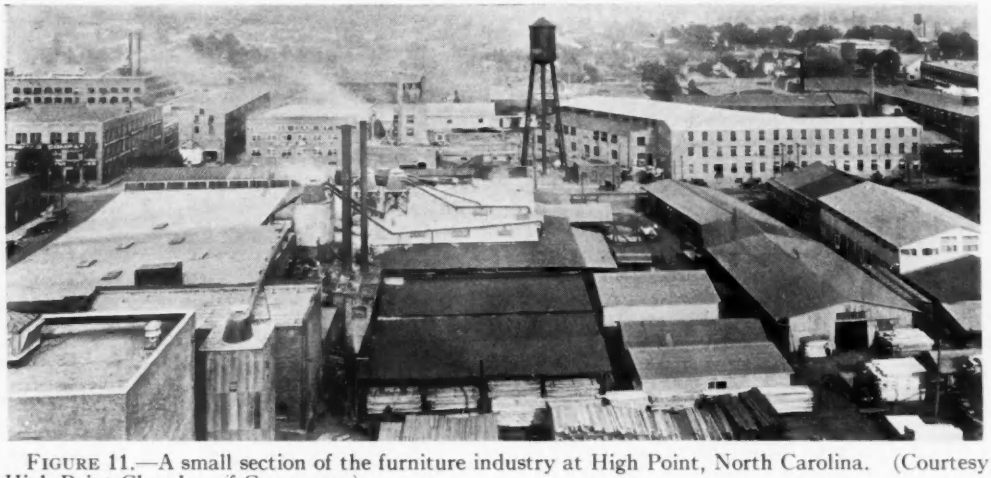

FIGURE 11.—A small section of the furniture industry at High Point, North Carolina. (Courtesy High Point Chamber of Commerce.)

DECENTRALIZATION

The Piedmont furniture industry is decentralized with spots of centralization. High Point, North Carolina, is the chief furniture manufacturing city with 36 factories. Other cities such as Thomasville and Statesville, and Martinsville, Virginia, are important centers but the industry is spread over an area two hundred miles long and one hundred miles wide. Many factories are located outside towns, surrounded by forests, a connecting switch to the railroad, and the power line running down from across the hills. The industry can be decentralized because, throughout the region in which it has developed, there is an abundance of labor, raw materials, fuel, power, and transportation. Such freedom of location promises cheap land, lack of crowding, and plenty of space for the lumber yard and the sidetracks. It provides

FIGURE 12.—This twenty-five-year-old field pine thicket is illustrative of the way that the pine grows throughout the Piedmont and Coastal Plain regions of the South. (Courtesy Duke Forestry Department.)

cheaper insurance due to lack of crowding and fire hazard. It insures easier and quicker delivery and receiving of goods because of avoidance of traffic delays. Light and air conditions are better; employees can live close to the factory and avoid delays in getting to work.

As for the employee, decentralized industry makes it possible for him to live in a forest if he so desires. He can have a lawn and a garden and a house at much less cost either for construction or for rent than if he were in a large city. He has more time to himself because he consumes less time going and coming from work, and this in itself makes such working conditions desirable. His children attend the excellent schools of the Piedmont region, one of which is never far from his home. They can grow up without experiencing the crowded, dirty conditions of the city where the children are often like rats in the gutters. And in such a situation, the employee knows his employer, both understand each other better and with this better understanding comes a greater coöperation.

ATTRACTION OF OTHER INDUSTRIES

The growth of the Piedmont furniture industry, like that of other industrial developments, has attracted many dependent and independent industries into its midst. The city of High Point is an excellent illustration of this attraction. Besides its furniture factories, are factories manufacturing paints, stains, varnish, shellac, glue, lacquers, enamels, furniture polish, upholstery springs, upholstery materials, mirrors, art glass, veneers, mattresses, bedsprings, paper boxes, corrugated cartons and other shipping containers.

In addition to these dependent industries are machine shops, wood-working machinery repair shops, electrical equipment repair plants and construction plants, and several wood-working machinery manufacturing plants have arisen in the region. Such developments of dependent industries and servicing industries avoid delays in shipments of supplies and delays due to breakage and replacement of machines.

Industries slightly related to the furniture but which have sought location in

its proximity embrace such types of manufacturing plants as trucks, shuttle blocks, bobbin heads, street cars, batteries, caskets, and wooden and steel office furniture.

Independent industries, yet types that might be termed parasitic because of labor, are the cotton, woolen, silk, and knitting mills that have surrounded the furniture manufacturing region. Some of the cities that are important for furniture production, though still boasting of the amount of furniture they produce annually, have reached the stage where they are really important more for total production of textiles than for furniture. The furniture city of High Point boasts of its furniture production and is eager to show its large Furniture Exposition Building, yet it has three large cotton mills, two silk mills, and seventeen hosiery mills, the combined production of the hosiery mills alone in normal times approximating $25,000,000 with an annual payroll of $5,000,000.

In addition to those mentioned many other industries have sought locations near the furniture development, for the larger the furniture development the greater demand for agencies serving the people connected with it. They must be fed, clothed, amused, and transported, their health supervised and their children educated, all of which activities require many additional agencies and people to insure that everyone may function properly.

FIGURE 14.—New styles of furniture, as well as improvements incorporated in the standard types, are exhibited in this fine structure, the Southern Furniture Exposition Building at High Point, North Carolina, which is open the year round. Two furniture shows are held annually, one in the latter part of July and one in the latter part of January, to which dealers and firms from all parts of the United States and from a large number of foreign countries send their buyers and representatives. (Courtesy High Point Chamber of Commerce.)

FIGURE 13.—Representative stand of bottomland hardwoods, yellow poplar, red gum, and birch. (Courtesy Duke Forestry Department.)

OWNERSHIP

The Piedmont furniture industry, like 94 per cent of the textile industry of North Carolina and all of the tobacco industry, is a Piedmont development, financed by, built by, and operated by Piedmontese. It buys millions of dollars' worth of raw materials from the people of the region annually. It distributes millions of dollars to the citizens of North Carolina and Virginia annually, in the form of wages. This money goes into the banks of the region and in combination with profits from the industry, is used to build up the industry itself, or is invested in other Piedmont industries. Many of the men and

groups of men who own furniture factories, own textile mills, have money invested in tobacco plants and other industries, and the success of one type of industry aids the success of the other types.

CONCLUSION

The Piedmont furniture industry is relatively new, it is not subjected to the disadvantages of absentee ownership, it is not hampered by time-worn traditions, and because of its success and newness is not afraid to adopt new ideas and enter upon new fields.

The Piedmont furniture industry enjoys low production costs because it has adapted its type of manufacture to the region in which it has developed and to the broad strata of the market that it serves. If it is permitted to continue, unhampered, in the policies that have fostered its growth, the prospects for continuous development should be bright.

LAND ECONOMY OF WARREN COUNTY, KENTUCKY

J. Sullivan Gibson

PART II

KENTUCKY claims natural kinship with the South by virtue of its humid mesothermal climate, common ethnic stock, and agricultural program strictly derivative of the pre-Civil War plantation system. Of the several geographic regions of Kentucky the Pennyroyal most nearly epitomizes the state. Its location intermediate between other major regions of Kentucky and Tennessee imparts to it the qualities of a corridor and facilitates the blending of its ethnic and cultural qualities. Physically, the region exemplifies practically all the characteristics of the state from one extreme to the other while its culture, shaped largely by physical limitations, is no less diversified.

Warren County lies near the center of the Pennyroyal and displays a large range and variety of conditions, combining within a relatively small space the extreme physical and cultural qualities of the entire region. The Pennyroyal contains no better land than the deep, fertile, treeless, undulating, limestone plain of the southern part of the county, while in the northern part, rugged hill country with thin, infertile, sandy soil has perhaps as low agricultural potentialities as any part of the region.

The St. Louis limestone, which characterizes much of the Pennyroyal, disappears in the northern part of Warren County beneath younger series, uppermost of which is the Chester sandstone, capping the higher ridges and divides. The transition from the limestone plain to the sandstone hills is accomplished over a south-facing escarpment rising abruptly more than a hundred feet, which appears in the eastern part of the county as a fault scarp, but gives way farther west to a wider zone of dovetailed ridges and valleys. Thus divided, Warren County consists of a productive, undulating limestone plain stippled with solution features, a rugged sandstone hill country of low productivity, and a foothill transition zone between.

ECONOMIC STATUS OF THE HILL PEOPLE

The cultures of the hilly northern part of Warren County and of the limestone plain differ as widely as their physical character. The chief cultural differences between the two regions, one may say, have resulted very greatly from physical differences, and therefore, are highly environmental. Both cultures, however, are products of the past as well as the present; in both regions nature has set up physical limitations that have determined largely the activities of men; likewise they have also determined those characteristic customs that past generations have handed down to the present.

There is little or no difference in the original white stock of the two regions; on the contrary, the white population of the whole Pennyroyal is strikingly homogeneous. The only significant racial difference between the two regions represented in Warren County is determined by the negro element. Negroes are quite numerous in the plains sections where large-scale farming creates a demand for cheap labor; but in the hills where farms are small, tenants are not

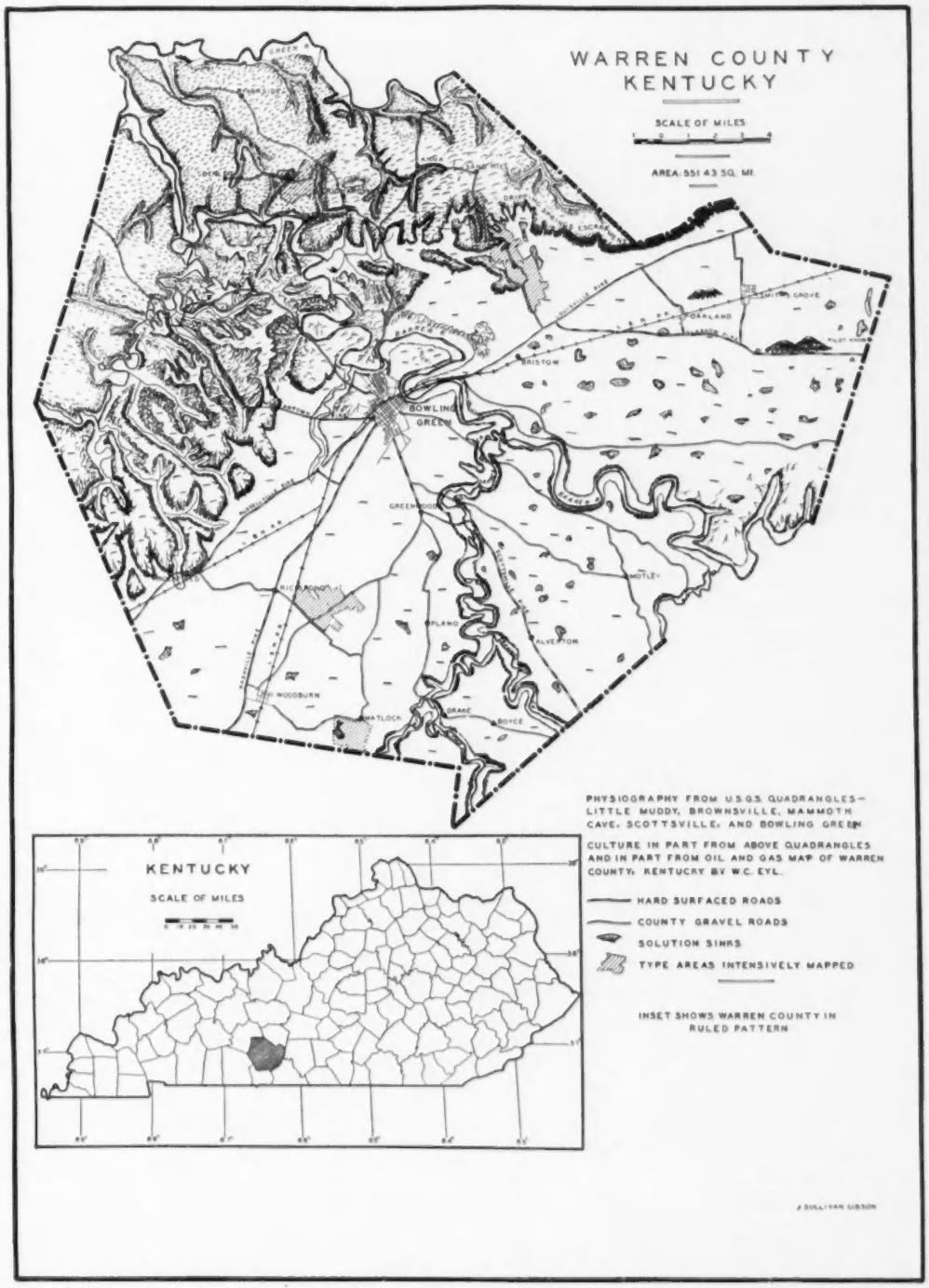

FIGURE 1.—The wide range of physiographic features in Warren County, Kentucky, varying from a dissected sandstone upland to a productive solution peneplain, condition two opposing regions of great physical and cultural contrast.

numerous and the negro finds no place. Greencastle District, the only district of the county located entirely in the hill country, has not a single negro resident,

and other hill sections of the county have very few.

People of the hill country are chiefly natives. The majority of them own their homes and may represent the third or fourth generation that have occupied the same land. A small minority constitutes a shifting element of transient occupants who never attach themselves permanently to the land and, consequently, contribute very little to the community. Practically all types of citizens fashion the populace of the hill country, from the dishonest, trifling class, whom neither banks nor neighbors can trust, to the highly respectable, thrifty farmer with comfortable home, substantial bank account, and a reputation for civic and social leadership. People who have been in position to observe developments in Warren County for the last quarter to half century regard the citizenry of the hill communities as a rather thrifty type, functioning as loyal residents and fitting into their environment in a remarkable way.

THE TYPICAL HILL COMMUNITY

The typical hill community of 20 to 40 families, chiefly of native stock attached to their land by hereditary bonds of love for home, who occupy an equal number of farms spread in irregular order about the country store, church, or one-room school which may, perchance, stand at the cross-roads, comprises no less a civic and social unit than the thriving village or town of the most progressive agricultural plain. The country roads that radiate from such a hill community center wind in a more or less haphazard way, serving the farmers of the neighborhood as outlets to the local center, to neighboring communities, and to highways leading to the county seat. In this age of the automobile, outlet to a passable road constitutes a factor of importance to every farmer. Although most farms have frontage on such a road, others are isolated and their occupants suffer the distinct disadvantage of impeded conveyance.

An air of individuality distinguishes every community, yet all hill neighborhoods have much in common. The different panoramas from various points of vision are strikingly similar. The irregular layout of community and of individual farms is conspicuous. The hillside farm with gullied, abandoned fields and dilapidated buildings, is always visible; while the better type farm with valley bottom fields, a comfortable residence, and good barns lends an air

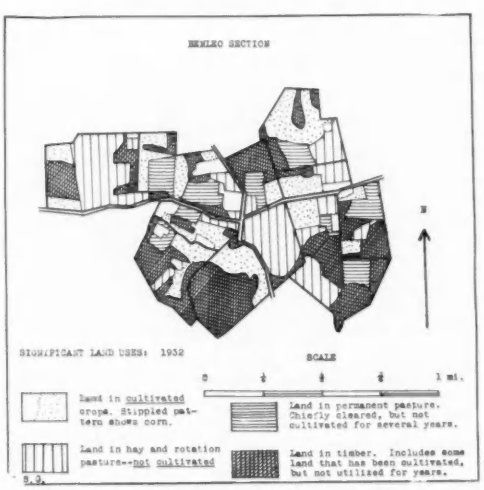
BEMLEC SECTION
N
SIGNIFICANT LAND USES: 1932
SCALE
0
1 mi.
Land in cultivated crops. Stippled pattern shows corn.
Land in permanent pasture. Chiefly cleared, but not cultivated for several years.
Land in hay and rotation pasture--not cultivated
Land in timber. Includes some land that has been cultivated, but not utilized for years.
S.S.

FIGURE 2.—The high timberland ratio and the low percentage of cultivated land suggest the dominance of relief and soil poverty in the agriculture of the hill country.

of prosperity to the landscape. A patchy field pattern prevails both on the slopes and in the valley bottoms, and only on the level, upland, sandy tracts, does this give way to a rectangular pattern of larger fields. Timber clothes many of the steeper slopes and a considerable amount of the flat area as well; yet a surprisingly large amount of the land is cleared. The gullied, abandoned slopes lend conviction that much

FIGURE 3.—Upland view near Anna. On the upland flats fields are relatively large and assume a more regular pattern. The good appearance of residence and other farm improvements is exceptional.

more of the hill country should have retained its forest cover.

Farms range in size from a few acres to 200 or more, but extremely large and extremely small holdings are rare. The general average is from 50 to 100 acres. Different farms vary greatly in their percentage of cleared land, depending somewhat upon the slope; but on practically all farms idle clearings either lie abandoned or idle for recuperative purposes. Rarely does more than one family occupy the same farm, but occasionally the same farmer operates a neighbor's farm in addition to his own.

The hill country displays a great variation in types of dwellings, from old, dilapidated, one or two-room shacks to comfortable, well-kept, attractive, five and six-room bungalows. But the new, modern type home is rare. Most of the better farmsteads have small, one-story frame or weatherboarded box dwellings to which the owner has added additional rooms as his family needs and his financial means increased.

The same plan operates with regard to barns and other farm buildings. Instead of a single large barn a farmstead often includes several small barns, cribs, and sheds. Many farm buildings are constructed of home-sawed lumber and covered with handmade boards; sheet-iron is used increasingly for barn and residence covering. The typical farmstead picture would not be complete without the haystacks that stand in the open feed lot near the barns. Farmers house very little of their hay. As mildness of winter weather makes housing and stall-feeding unnecessary, cattle and work stock feed from the uncovered haystack, rather than from the manger, during the period of sparse pasture.

On the whole the hill farmer tills his land very little; steepness of slope and thinness of soil will not permit it. He plows shallow and cultivates infrequently. An interesting and quite significant point to note is the fact that on account of slope erosion, these farmers cultivate only a small percentage of the potential crop land each year. Figure two shows, in open pattern, the land in the Benleo section that was actually cultivated in 1932. The considerable amount of land in hay and rotation pasture was not plowed, but profited somewhat by a rest from cultivation. The ordinary program is a four to six-year rotation consisting of: corn, tobacco, or peas, one year; hay, one or two years; and pasture, two or more years. Some of the steeper slopes are cultivated only once or twice in 10 to 15 years.

Besides supplying the farmers of the community with groceries, gasoline, and other necessities, the country store serves

as a market place for eggs, butter, and other farm commodities. It is much less significant now than a generation ago, however; since automobiles have become numerous and the county is graveling many of its roads it is relatively easy for these hill people to market their produce and do their shopping in Bowling Green and other towns. The little country church and the rural school play a part in holding the community people together in a social way; but they, too, are losing their significance as the people are turning more and more to the city for their social satisfaction.

PROPERTY OWNERSHIP

A surprisingly high percentage of the people of this region own their farms. Land ownership is an attainment to which all aspire; practically all permanent residenters of the average hill community own some land. Many holdings are small. Some persons buy small tracts of three to 20 acres on which they build a small house and make their permanent home; as a rule these small holders rent from their neighbors land which they cultivate in addition to their own.

The per capita wealth of the hill country is relatively low. The average farm value was less than $2,000 in 1929 and many farms represent a value as low as $200 to $1,000 each. Much of the unimproved land has a sale value of $10 an acre or less, while the best improved farms are valued at only $25 to $35 an acre. The average farmer, then, is a small investor. His $1,500 farm represents his lifetime accumulation, and on it he supports his family and lives happily and contentedly. He must supply many of his needs direct from his farm, for his cash income is relatively small. The total income, including products consumed, sold, and traded from 18 farms mapped in the Benleo and the Sand Hill sections averaged $591.50 per farm in 1929 according to the 1930 United States agricultural census. This amount includes products with an estimated average value of $192.78 per farm which were consumed by the farmer's family. Thus each farmer had left approximately $400 with which to buy groceries, clothing, farm equipment, automobiles, gasoline, and other necessities, for making repairs and other improvements, for educating the children, and for paying taxes and debts that might accumulate.

FIGURE 4.—Detailed land use map of the Sand Hill Section, 1932. The winding ridge road and the patchy field pattern are strikingly characteristic of the hill country. The dominance of timber along the southern border marks the escarpment.

The ratio of farm income to farm value is surprisingly high throughout the hill section. For one group of farms in the Sand Hill section this ratio was about 78 per cent in 1929. The average for the 18 farms referred to above was considerably less, amounting to 42.3 per cent. On the better farms on the limestone plain the ratio was much lower,

ranging from 20 to 30 per cent on the average. If no allowance is made for labor, from the viewpoint of returns on investments the hill farm is relatively profitable; but in consideration of the fact that the actual returns the farmer and his family get from their investment and for their year's work combined is only $600, how these people maintain their cultural level becomes a source of wonder!

The hill people do much of their work by hand. Rugged relief and low buying power preclude the use of much machinery. The more thrifty farmers have hay machinery and serviceable plows where the relief permits their use; but the small holder in the extremely rugged parts does most of the work of his farm with hoe and walking plow. One or two ponies or mules suffice for his needs, while the more prosperous farmer rarely owns more than three or four work animals. Few cattle in the region, other than milk cows, enrich the farm economy. Some farmers keep small flocks of sheep and goats. As these animals feed on brush and short grass, and cost the owners very little to keep, they fit well into the farm economy of the region. Probably the greatest benefit derived from the few livestock is the manure retained in the fields, some of which are pastured every year in the rotation program practiced.

The average hill farmer is economical by nature and by necessity. In his efforts to gain a livelihood in a land of such limited resources he cannot live extravagantly, but he must be resourceful and, to a great extent, self-sufficing. He does not feel the need for cash income because his needs do not extend far beyond his ability to produce at home.

With an average farm value of less than $2,000, with additional assets rarely exceeding a few hundred dollars at most, and an average cash income of only $400 per year, the hill farmer cannot furnish securities for heavy loans. Banks are not eager to advance them money in large amounts, hence they cannot become deeply involved in debts should they wish to speculate. Because of these two facts—self-sufficing nature, and inability to furnish securities—these hill people, as a rule, keep clear of debt and most of them have small bank accounts. Two prominent bankers of Bowling Green state that they much prefer the banking business of the hill farmer to that of the farmer in the fertile limestone plain who has been a borrower rather than a depositor. Several banks in the county have failed in recent years chiefly from heavy loans to farmers on expensive farms in the southern part of the county; on the other hand, some other banks have been able to operate, chiefly on account of the deposits of the small farmers in the hill sections.

FIGURE 5.—One of the better homes of the hill country.

During the present period of depression the hill farmer, like most other people, has been hard pressed. Many of them are now in debt as far as their securities will permit. Before 1930 the percentage of mortgaged farms was about the same all over the county, and not very different from that of the state at large, which was one in every three.

The larger and more expensive hill farms had a higher percentage of mortgaged indebtedness than the average sized and small farms. The 18 farms mapped in Benleo and Sand Hill sections, referred to above, had a mortgaged indebtedness amounting to only

FIGURE 6.—The only kind of a home known to some farm tenants in the hill country.

5 per cent of the total value in 1930, while 22 other hill farms investigated, averaging 38 per cent larger and 107 per cent higher in value, had a mortgaged indebtedness of 26 per cent of their total value. This condition bears out the principle that people of limited securities are not at liberty to become involved in burdensome debts.

Farm mortgages run considerably higher to-day than five years ago. Statistics for present indebtedness are not available, but tax-office and bank reports reveal a considerably lower percentage of mortgaged farms in the hill country than in the better farming territory southward, and the per capita indebtedness in the former region is only a fraction as great. Some hill farmers have lost their farms in recent months, but the majority still retain home ownership and will be able to pay off the mortgage in a few years if they can again obtain good prices for their products.

SOURCES OF INCOME

CROPS

The hill farmer has little control over the physical handicaps that face him; likewise he has little choice of soils and slope in selecting his crops. He cultivates practically all of his cleared land at some time in the rotation program. The degree of slope means little to him if its surface has a soil covering sufficient to grow a crop for one or two years. Slopes ranging up to 15 degrees or more may produce a meager crop of corn the first year or two after clearing. Corn, as a rule, is the pioneer crop on all new land; but any one of the several crops of a given hill community grows on every variety of slope and soil. There is a tendency, however, for tobacco and strawberries, both cash crops, to receive choice soils and gentle slopes.

Among the hill people corn is by far the most important crop. In acreage it exceeds all other cultivated crops combined. Hay is the only other crop that approaches it in importance and that by virtue of the fact that hay requires no cultivation and the land produces a crop while resting from erosion. Although tobacco and strawberries occupy a relatively small acreage they are significant crops. They constitute the only strictly cash crops, and when yields are good and prices are high they may produce a considerable income. These crops are produced here on such a small scale that little or no extra expense results from their cultivation and handling, and the proceeds are practically all profit. More farmers grow tobacco than strawberries, but the latter is gaining prominence as marketing organizations develop.

TIMBER

In so far as income is concerned most of the timber of the hill country is an absolute waste. The greater part of the timber land is not pastured at all; it serves the owner only as a supply of fire wood and fence posts. Some farmers place considerable value on their timber, however; some list timber for taxes, but

most of them pay no taxes other than that charged on the land. A number of small sawmills operate a few days in the year making rough lumber chiefly for barns; all this is put to local purposes, the user of the lumber usually furnishing the timber and assisting with the sawing. Some farmers make boards, by hand, for barn and residence covering. The amount of homemade lumber, although small, is quite significant to a people with limited means for purchasing materials for construction and repairs.

LIVING STANDARDS

Living standards serve as a fair index of a civilization. Several factors enter into an analysis of living standards of a community, significant of which are food, clothing, living quarters, purchasing power, transportation, education, and religion. Each of these factors may vary from one community to another; but no one of them loses its significance in any rural community.

FOOD

The hill people of Warren County are not undernourished. On the contrary the majority of them have more substantial food than many people of better farming sections where emphasis falls on cash crops. Home produced food is highly significant in this region where agriculture approaches the subsistence type. Most farmers have gardens which supply vegetables, and orchards from which they gather peaches, apples, and other fruits for fresh eating, canning, and drying. On a small percentage of farms strawberries, grown chiefly for market, also contribute to the home food supply. Beans, potatoes, and yams are of considerable significance on many hill farms; some farmers store up for winter quantities of these commodities which they exchange with neighbors for other products, for labor, or for cash.

The significance of corn in every hill community suggests that hogs might be raised easily and cheaply. Most farmers produce their home supply of meat and lard, and occasionally they raise a few hogs for market. Because of the vitamins that milk and milk products contain, the dairy cow serves as a good index of food supply, and, hence, of general living standards in a given community. In many marginal and submarginal regions, milk is lacking in the diet of most people; this results in a subnormal physical condition. Most people in the hill country of Warren County keep one or two milk cows and have milk and butter most of the time. As there is little sale for milk and cream in the remote sections off the milk routes people who do not have a cow can usually obtain milk from neighbors. There is no apparent deficiency in milk supply among the hill people. Most farms raise a few chickens to supply enough eggs for home use and some for sale at the country store.

FIGURE 7.—Hudson's store near Benleo. The gasoline pump is conspicuous at every crossroads store.

The author was somewhat impressed by the significance of home produced food when he took dinner in the home of a Benleo farmer in March, 1933. The menu included the following items of food produced on the farm: pork, pork sausage, eggs, beans, white potatoes, sweet potatoes, milk, butter, two or three kinds of fruit, and cornbread.

The farmer is one of the more prosperous farmers of the neighborhood and, no doubt, lives somewhat better than the average farmer of the community; but there is little doubt that, on the whole, the hill people of Warren County provide themselves with a reasonably good supply of nourishing food.

CLOTHING

Relatively low buying power forces the hill people to be somewhat more economical in their dress than people in the better farming sections. Much of the time men wear ordinary work clothes consisting of duck trousers or overalls, cotton shirts, and heavy shoes; but for Sundays and for special wear they have better clothing. The sewing machine has a place in most homes and the farmer's wife makes much of the clothing worn by the family. Some of the girls and women possess silk dresses, but except for special wear, they adhere to the cotton dress, much more in keeping with their ability to buy. On the whole the clothing of these people is more indicative of low buying power than is the daily diet. They produce nothing to use for clothing except a little home-tanned leather for shoe repairs. They must buy practically everything they wear, and the meagerness of an average yearly cash income of only $400 per family is reflected somewhat in their dress.

ROADS

Roads in the hill sections are generally poor. They wind about in irregular pattern. Usually they follow the ridge tops, crossing from one ridge to another over steep, rough slopes. Creeks are poorly bridged if bridged at all; roads cross most of them at fords. The county owns most roads, and perhaps spends a reasonable portion of tax money on them. But road construction is difficult and expensive in the rougher sections and much of the work is done in a careless, wasteful manner. A relatively high percentage of the roads is graveled and passable by automobiles at all seasons. There is still a considerable mileage of unimproved dirt roads that automobiles can travel only in dry weather. Most roads are rough, and hard on cars and other vehicles using them.

THE AUTOMOBILE

There is much to say for and against the automobile in this region. A rather high percentage of farmers own one; and as the county is improving more of its roads automobiles are increasing in numbers. During the present depression period, however, few of the small farmers have bought cars. A common scene at many homes is an old, worn out Ford or Chevrolet either discarded or in a bad state of repair. Most car owners go in debt for them. These debts, which often take most of the earnings of the farm, are rolled along from year to year and often last longer than the machine. Many farmers spend more money for gasoline and repairs than for groceries. A few thrifty farmers can well afford cars, and as a rule, they use them wisely. But for the average hill farmer with meager income the automobile, although a convenience, is frequently a distinct handicap. It has robbed him of his bank account, and in many instances has placed him in debt. In light of the meager income of the hill farmer and the expense of owning and operating a car in a region of poor roads, it is clear that, from several viewpoints, the automobile is a disadvantage rather than an asset to the average hill community.

THE SCHOOL

The rural school is a significant factor in the community life of all rural

Kentucky. Warren County has 67 rural schools, 54 of which are of the one room type, while 13 have two teachers each. The hill country depends chiefly on the rural school for educating the youth, and this dependence is not always competently met. A prominent educator of Western Teachers College at Bowling Green who has given many years to the study of rural schools of Kentucky stated that as a rule the poorest teachers in Warren County teach in the rural schools of the hilly sections, a distinct disadvantage educationally. Schools open in July and close in January, a desirable arrangement for the county because the roads are almost impassable during the rainy weather of late winter and spring. Attendance is often low in December and January as a result of bad weather. The rural school, as a rule, is crowded and poorly equipped, and offers poor opportunities.

A strong movement toward consolidation of rural schools all over Kentucky is a praiseworthy movement toward improved educational conditions and elevated living standards generally; but the doubt arises, however, whether school consolidation is a good movement in the poor, rugged parts of the county. A rise in living standards, which consolidation leads to, tends to an increased drain on the land already taxed to its utmost capacity. The average hill community cannot support its population if living standards, and hence, living expenses are raised very much. Any movement which may cause a community to overstep the potentialities of its land may, in the long run, prove detrimental to that community by rendering the area submarginal and by leading to depopulation.

THE CHURCH

The country church has lost much of its significance over the state in general. It is doubtless more significant in the hill country than in the level parts of the county where better roads facilitate church attendance in the villages and towns. Most of the people are Protestants; a high percentage are affiliated with the Methodist or Baptist faiths. As a rule all denominations use the one church building where services are conducted once a month by a pastor who rarely lives in the community.

THE FUTURE

The hill country of northern Warren County appears destined to remain a land of small farms of low productivity and small monetary worth. The soil, naturally of low productivity, can scarcely be rebuilt by any economical means, when once it is depleted; hence its value for agricultural use continues to depreciate. Subsistence agriculture is as nearly attained here as anywhere in the South; it will probably remain the system of the future. The hill people have little opportunity ever to rise much above their present level of living. They very probably will roll away the debts brought on by the present depression period sooner than will farmers of the better farming sections; many of them will rebuild their bank accounts, but one cannot expect many of them to accumulate much beyond the necessities of life. The hill people fit remarkably well into their physical setting; in the future they doubtless will continue to play the rôle of hardy, contented, patriotic citizens, making the best of the opportunities offered by their environment of limited opportunities.

RURAL ECONOMY ON THE LIMESTONE PLAIN

The various levels of culture within the Pennyroyal result chiefly from a gradation of land potentialities. The homogeneity of original white stock

precludes any ethnic stratification. The physical environment varies greatly for different parts of the region; but the variation in carrying capacity is the most significant of the physical variables in

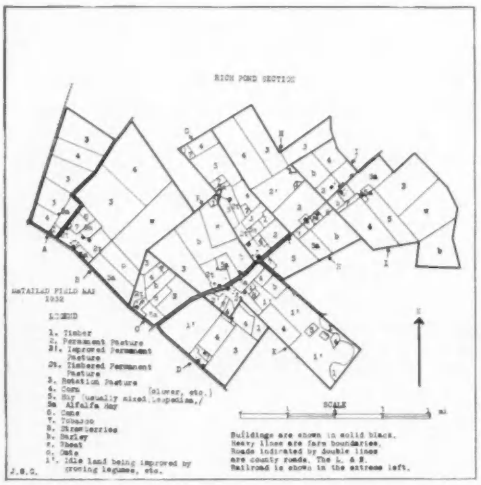

FIGURE 8.—The rectangular pattern of large fields suggests the profitable system of machine agriculture potentialized by productive soil and favorable relief.

shaping human culture. The rugged relief of the hill country is much more significant as a limitation to production than as a hindrance to transportation, while the productivity of the limestone plain, and not merely the flatness of surface, sets the cultural standards for that area.

The limestone plain, to which the southern part of Warren County belongs, is the most productive part of the Pennyroyal and one of the best farming regions in the State. When farm commodity prices were high people of the area prospered, and society advanced. Living conditions were good among the majority and civic development continued at a pace in keeping with the times. In recent years of depression, however, the communities have suffered greatly. The high living standards adopted during the period of prosperity terminating in 1929 require heavy cash expenditures which are difficult to meet by farmers whose products find no sale. Heavy debts have accumulated, much of the taxable property is mortgaged and many farmers have lost their homes; several banks have failed as the result of heavy loans on which collections have been impossible, and others have found it necessary to take from their debtors a considerable amount of land and other property for which there is little sale.

The best part of the limestone plain presents a landscape strikingly suggestive of its high qualities. The reddish-brown Clarksville loam soil, rich in humus as well as in plant food minerals derived from parent limestone, suggests high productive capacities; while its orderly layout of well-kept farms, buildings, and roads is none the less indicative of an excellent farming region. The good qualities of the area are obvious; it is a prosperous, good-looking farm section that attracts the attention of the observer—a region that registers in his

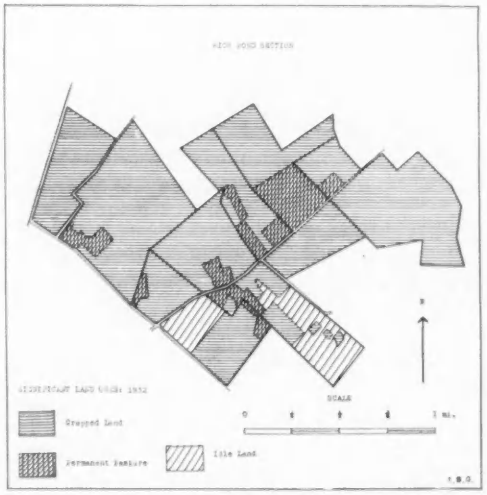

FIGURE 9.—Timber is insignificant in this area. A few small patches of timber are included in the permanent pasture, while a small amount of the land mapped as idle is in timber and brush. Most of the idle land, however, is seeded in soil-improving grasses and will be back in regular rotation within the next one or two years. Relatively little land in this area is unutilized for regular farming purposes.

mind as being equal to the Bluegrass, or to the prairies of Illinois or Texas.

An illustrative area that we may designate as the Greenwood-Rich Pond-Woodburn area stretches from the vicinity of Drakes Creek east of Bowling Green southeastward, leaving Warren County south of Woodburn nearly 20 miles from its northeastern border. A similar area extends from the upland east of Barren River, eastward to the Edmonson County line, approximately bisected by the Louisville and Nashville Railroad, and including the communities of Bristow, Sunnyside, Oakland, and Smiths Grove. Physiographically, the limestone plain embraces these two areas, and extends across the county for a distance of 40 miles from northeast to southwest, broken near its center by the valleys of Barren River and Drakes Creek. The width of the region varies from three to eight miles; it has an area of about 160 square miles, or approximately 30 per cent of the county.

FIGURE 10.—Hundreds of perch of limestone gathered from the surface, awaiting the crusher. A view from Dixie Highway one mile northeast of Rich Pond.

A TYPICAL COMMUNITY ON THE LIMESTONE PLAIN

About the village of Rich Pond spreads the gently undulating limestone plain on which Pennyroyal agriculture finds its optimum development. Stretching for miles in broad, billow-like swells, uninterrupted by surface streams and only slightly broken by occasional solution sinks and ponds, the plain displays large, well-kept farms producing abundant crops of corn, wheat, and tobacco, and supporting a farm economy and culture that compares well with the best in the South. The physical and cultural landscapes harmonize remarkably. Farms and roads conform to the rectangular pattern, while the layout of fields and the arrangement of buildings and grounds show careful planning. A remarkably high percentage of the land is cleared and cultivated; timber, although not altogether lacking, is restricted to small woodlots and to permanently pastured patches where trees serve as shade for stock. Very little waste land mars the area; practically every acre is utilized in some profitable way or seeded to legumes or other soil-improving plants, thus insuring continued productivity of soils that might otherwise become depleted under constant cropping.

Farms range in size from 50 or 60 acres to more than 1,000 acres with relatively few of the smallest or largest types. The nine farms mapped, which collectively typify the entire region, average 164 acres, approximately twice the size of the average hill farm in the northern part of the county. The high productivity of the reddish-brown soil, a large percentage of which produces a

crop every year, insures an average income several times as great as that of the hill farm.

In this section most farmers practice large scale methods. The tractor is used on practically every farm for plowing and for harvesting grain, while a few farmers use teams of two to six mules each for this work. Two-row planters and cultivators contrast strikingly with the one-mule plow of the hill country, while the power hay press and the grain

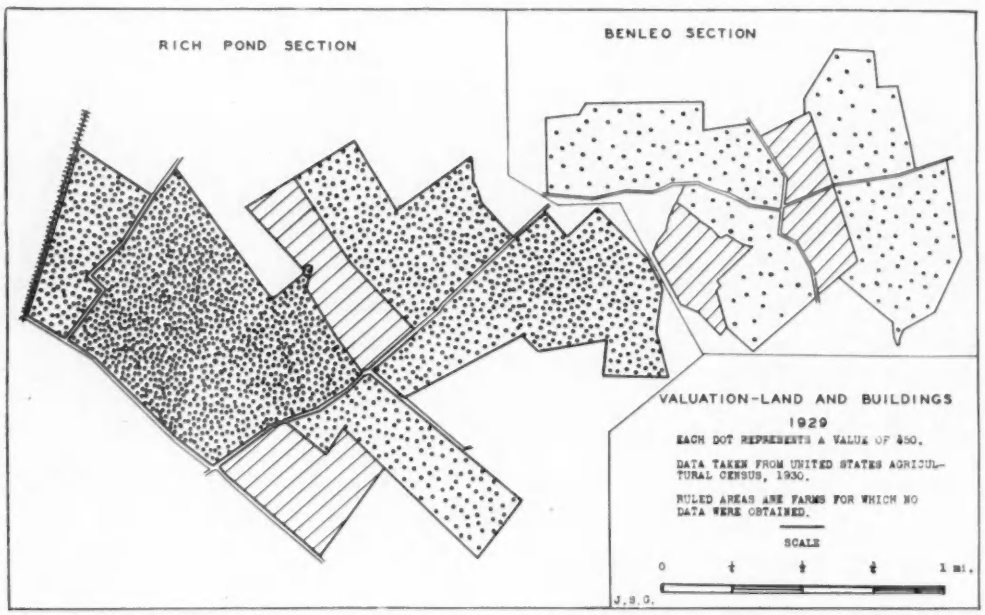

FIGURE 11.—A striking concentration of rural wealth on the limestone plain harmonizes with the superior physical and cultural landscapes of this region.

combine used in this section are likewise impractical in the hills. This method of farming naturally calls for an orderly layout of relatively large fields, in rectangular pattern, conveniently arranged for rotation practices.

A considerable variation in type and quality of dwellings reveals itself in the section. The farmstead home, however, is usually large, comfortable, and in good repair. Some are large, expensive buildings, equipped with running water, gas, electrical appliances, radio, and other modern conveniences. A few of the old colonial mansions, built a half-century to a century ago, remain as landmarks of the pre-Civil War plantation system. The newer homes, however, are frame or brick bungalows, modern and well equipped, but more conservative in size and cost. Tenant homes, as a rule, are small box houses, poorly constructed and uncomfortable.

Barns and other buildings suggest the large scale methods which farmers practice. On most farms, at least one large barn supplies storage for corn and hay, and for housing work stock and milk cows. Most barns, which usually are unpainted or painted red, are in good repair; however, a few dilapidated barns are still in use. The number and size of barns are usually in keeping with the size of the farm, the number of livestock kept, and the amount of feed stored for winter feeding. On the larger farms three or four fair sized barns are needed, besides a tobacco barn, a granary, a ga-

rage, a smokehouse, and possibly other buildings. Some farmers store hay in the open, but they house much more of it than do farmers in the hill country.

The Dixie Highway passes through the northeastern edge of the community and gives excellent connection with Bowling Green, Franklin, and Nashville. County gravel roads serve all parts of the community and connect them with other neighborhoods of the southern part of the county and with Bowling Green via Greenwood. The gravel roads are well graded and graveled, follow a rectangular pattern, and serve practically every farm. Transportation presents no problem in this community. Most farmers own one or more automobiles and the good system of gravel roads serves them excellently at all seasons.

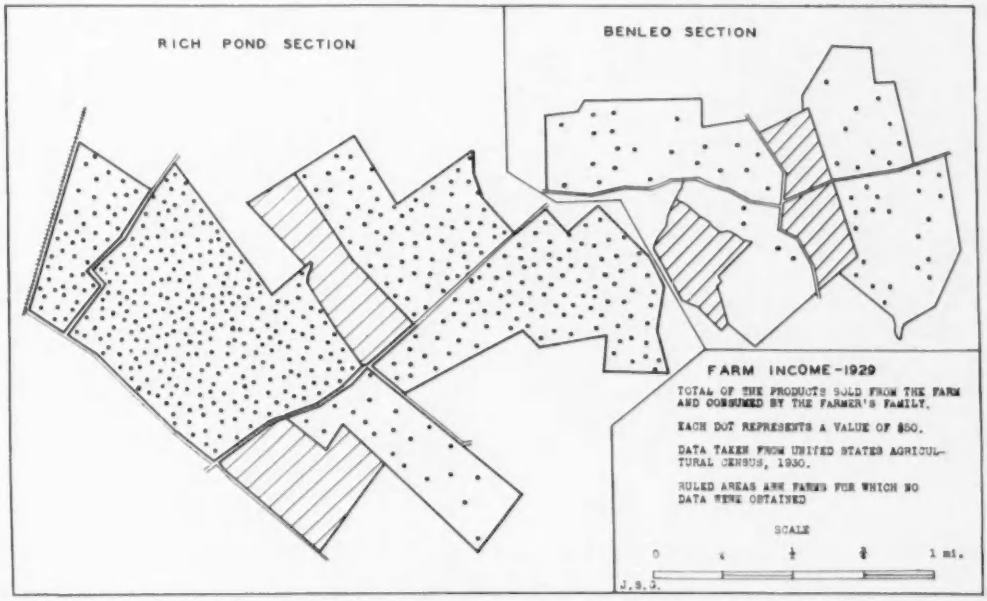
RICH POND SECTION
BENLEO SECTION
FARM INCOME-1929
TOTAL OF THE PRODUCTS SOLD FROM THE FARM AND CONSUMED BY THE FARMER'S FAMILY.
EACH DOT REPRESENTS A VALUE OF $50.
DATA TAKEN FROM UNITED STATES AGRICULTURAL CENSUS, 1930.
RULED AREAS ARE FARMS FOR WHICH NO DATA WERE OBTAINED
SCALE
0
1 mi.
U.S.D.A.

FIGURE 12.—More favorable relief and higher soil productivity explain a higher gross income per acre from the limestone plain. However, it is interesting to note that the ratio of farm income to total farm value is higher for the hill country. Compare with Fig. re 11.

PROPERTY OWNERSHIP

The per capital wealth of this region rises considerably higher than that of the hill country. According to the agricultural census of 1930, the farms and farm buildings of Hickory Flat Magisterial District, which lies entirely south of the hills, represents a value of $1,194 per farm inhabitant; this is two and one-half times that for Greencastle District, which is entirely hills. For the best farming districts, as the Rich Pond section discussed above, the per capita valuation is probably five times as great as the Greencastle average, while farms have an average value of about $90 per acre, or $15,000 each. This is about eight times the value of the average hill farm. Thus, the ratio of average farm values of the Hickory Flat and the Greencastle Districts is eight to one, while the ratio of the per capita wealth of the two districts is only five to one. This shows that a smaller percentage of the people own farms in the limestone region. The high cost of land makes it difficult for the farmer with little capital to become a home owner.

People of this region who do not own

homes fall into two classes: the tenant or share cropper, and the "hired hand." Most of the larger farms have one or more tenants who live in a tenant house on the farm and work a crop for themselves. The farm owner usually furnishes his tenant with seed, teams, and tools, sharing with him the proceeds, usually on a fifty-fifty basis. Frequently the tenant works part time for the land owner from whom he receives daily wages. Many farmers do not keep tenants but employ hired help instead. Ordinarily, after a farmer provides the necessary machinery and other equipment it is more economical to hire laborers and operate his entire farm than to rent part of it to a share-cropper. Tenant and hired hand alike frequently become permanently attached to the land and remain year after year contented with their lot. They never accumulate much property and most of them barely make a living, yet in prosperous times many may have substantial bank accounts. With little or no investments they have few responsibilities. They have little opportunity to contract debts; as a rule they live "from hand to mouth," and in depressing times maintain their financial level much better than do the land owners. Negroes are numerous; but very few own land. They function well as tenants and hired hands, for they are more content with their lot than are the white people in the same rôle, and as a rule are more satisfactory for the lower classes of work. Negroes constitute 20 to 25 per cent of the population of the section. Some farm owners live in town, leaving their farms entirely in charge of tenants, who look after the affairs of the farm for the best interests of all concerned and usually make money for the owner and themselves. As a rule, these tenants rank considerably above the average tenant and wage worker, socially and culturally.

Before 1930 the average percentage of mortgaged indebtedness was lower for this section than for the county at large; for the Rich Pond section mapped (Figure 8) this indebtedness amounted to about five per cent of total value, while for a total of 37 farms investigated in this region the average was 16 per cent. (The average farm indebtedness for the county was between 30 and 40 per cent of the total value.) These figures and corresponding figures for the hill country, given above, suggest that the best farms of the county, and the average farms of the hill sections, both represent safe and profitable investments in normal times, while the farm of medium size and value is less profitable, and accounts for the higher farm indebtedness for the county at large. A possible explanation for this situation is

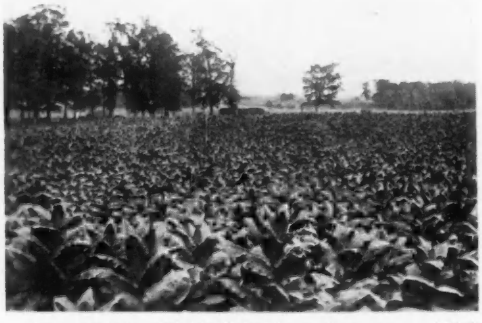

FIGURE 13.—Field of Burley tobacco near Rich Pond. The small tobacco patch of one to ten acres is the rule throughout the limestone plain.

the fact that on many of these medium sized farms the owners practice large scale methods at an expense beyond the potentialities of their farms. Neither the large nor the medium sized farm is an economical investment during the present economic depression, however, for most farmers of the better farming sections have contracted debts roughly

in proportion to the securities they can furnish.

With an average value of $15,000, a farm in this section must produce a substantial income in order to pay operating expenses and interest on the investment. The average value of commodities produced on the farms mapped in the Rich Pond section amounted to approximately $3,900 in 1929. This included all products consumed on the farm as human food, sold and traded, and amounted to 22 per cent of the total farm value, while the corresponding income amounted to 40 to 50 per cent for the hill country. If six per cent be allowed for interest on the investment and a liberal allowance be made for taxes, labor, fertilizer, machinery, and other necessary expenditures, about $2,000, on the average, remains to pay the farmer and his family for their year's work. This is about four times the income from the average hill farm. We may well take 1929 as a normal year, at least in so far as the income ratio of the two regions is concerned. This surplus—the margin of income above expenses—accounts to a very great degree for the higher cultural level of the plains region.

The farm owner of this region has heavy expense. The initial investment of $15,000 is considerable; and if the purchaser goes into debt for part of this amount, payment of principal and interest becomes burdensome. The machinery, teams, and other equipment necessary to operate one of these farms frequently cost more than the purchase price of an average hill farm, amounting to $5,000 or more on the largest farms. The average cost of machinery for each farm in the Hickory Flat District in 1930 was about $300, about three and one half times that of the Greencastle District. Labor costs also run high on many farms, especially on those that grow much tobacco. When crops are good and prices of farm products are high increased returns offset labor costs; but frequently labor costs are nearly as great in years of low yield and low prices as in prosperous years, and the farmer loses heavily. The average labor cost

FIGURE 14.—One of the finest farm residences in Warren County. The two-story piazza and suspended balcony are interesting carry-overs from southern colonial architecture.

for the farms mapped in the Rich Pond section was $400 in 1929.

Fertilizer is another item of considerable expense in this section. Most farmers apply some lime every year. By using local limestone the only expense of liming land is the labor cost; but this is considerable for a large farm. In some communities some farmers use a 33 per cent phosphate commercial fertilizer, which is much more expensive than lime. The fertilizer cost for the Rich Pond section was about $150 per farm in 1929. The more progressive farmers are rebuilding their soil by growing lespedeza, clover, alfalfa, and other soil improving crops during the present period of low prices while they can afford to leave the land idle.

Taxes, although ordinarily not considered an item of great expense, become of considerable significance during periods like the present. Taxes amount to $150 per year for the average farm of this section; such tax payment works a considerable hardship on farmers who find no sale for their products. At the time this survey was made in the sum-

mer of 1933 taxes were delinquent on a considerable amount of farm property in Warren County; in order to take care of such delinquencies, county authorities conducted public sales of much of this property.

The expense connected with the type and scale of farming practiced in this section is fully offset by abundant returns during periods of general prosperity; but in times like the present many farmers face bankruptcy. Some have lost their homes; others have avoided financial ruin by cutting expenses to a minimum and living within their income; still others have survived, at the same time maintaining their former standards, only by the expenditure of considerable sums of money accumulated before the crisis began.

The discussion of the limestone plain will be continued in the concluding installment of this article in the July issue, ECONOMIC GEOGRAPHY

ANNOUNCEMENT

THE concluding installment of *Agricultural Regions of North America* by Dr. O. E. Baker is scheduled to appear in the July issue of ECONOMIC GEOGRAPHY. In subsequent issues *Agricultural Regions of the World* will be continued with further discussions on *Agricultural Regions of Asia* by Dr. Samuel Van Valkenburg. Also in later issues Dr. Homer L. Shantz, President of the University of Arizona, will contribute his series on *Agricultural Regions of Africa*, which, upon conclusion, will complete the finest geographic discussion of the world's agriculture thus far established.

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The January issue of Volume 10 contains the following articles:

Softwood Resources of Europe, Thorsten Streyffert, College of Forestry, Djursholm, Sweden.
Agricultural Regions of Asia: Part V—India, Samuel Van Valkenburg, Clark University.
The Great Valley of East Tennessee, H. C. Amick, University of Tennessee, Knoxville.
Citrus Fruit Industry of the Los Angeles Basin, Clifford M. Zierer, University of California, Los Angeles.
Land Economy of Warren County, Kentucky, J. Sullivan Gibson, Clark University.
Agricultural Methods on the Canaries, Sören Jensen, University of Copenhagen, Denmark.

The October issue of Volume 9 contains the following articles:

Cereal Production in Turkey, G. Stratil-Sauer, Geographical Institute of Leipzig, Germany.
The California Fruit Industry, Robert W. Hodgson, University of California, Berkeley.
Natural Conditions for Coffee Culture, Olof Jonasson, University of Stockholm, Sweden.
Mining and Tourist Towns in the Canadian Rockies, Stephen B. Jones, Oregon Normal School, Monmouth, Oregon.
Agriculture of Rural England in the Seventeenth Century, G. E. Fussell, Ministry of Agriculture and Fisheries of Great Britain, London.
Ryukyu Islands, Japan, Yukuo Uyehara, University of Hawaii, Honolulu.
The Central Highway of Cuba, Edwin J. Foscue, Southern Methodist University, Dallas, Texas.
Resources of Yugoslavia, Joseph S. Roucek, State College, Pa.

July includes:

Location of South Africa and Its Economic Consequences, C. F. Hugo, University of Pretoria, South Africa.
Rumania Today, M. Catherine Roberts, Clark University.
Economic Conditions in Albania, Joseph S. Roucek, State College, Pennsylvania.
Bean Production in Michigan, Bert Hudgins, College of the City of Detroit, Michigan.
Distribution of the Mexican Bean Beetle, George E. Harding, State Teachers College, California, Pennsylvania.
Manufacturing in the Federal District, Mexico, M. Ogden Phillips, Washington and Lee University, Lexington, Virginia.
Development of Reindeer Activities in Alaska, Albert L. Seeman, University of Washington, Seattle.
The Philippine Question, Warren Dupre Smith, University of Oregon, Eugene, Oregon.

April includes:

Agricultural Regions of Asia: Part IV—India, Samuel Van Valkenburg, Clark University.
The Coast Plains of South India: Part II, Ethel Simkins, University College of the South West of England, Exeter, England.
The Balanced Economy of St. John Island, Earl Shaw, Worcester State Teachers' College, Worcester, Mass.
Agricultural Regions of North America: Part XI—The Columbia Plateau Wheat Region, Oliver E. Baker, U. S. Dept. of Agriculture.
Irrigation in South America, Dorothy Sisson, St. Louis, Mo., and R. H. Whitbeck, University of Wisconsin.

January includes:

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The Coast Plains of South India, Ethel Simkins, University College of the South West of England, Exeter, England.
A Southern West Virginia Mining Community, Raymond E. Murphy, Pennsylvania State College.
The Oahu Sugar Cane Plantation, Waipahu, John Wesley Coulter, University of Hawaii.
Kilgore, Texas: An Oil Boom Town, William T. Chambers, Stephen F. Austin State Teachers College.
Where Florida Truck Crops Are Grown, John L. Wann, University of Florida.

The October issue of Volume 8 contains the following articles:

Agricultural Regions of North America, Oliver E. Baker, U. S. Dept. of Agriculture.
Nomadic Pastoral Regions, Wellington D. Jones, University of Chicago, and Derwent S. Whittlesey, Harvard University.
Pattern of Copper Mining Terrene Occupancy in the South Range, Keweenaw Peninsula, Robert S. Platt, University of Chicago.
Economic Aspects of the Danubian Plan, Joseph S. Roucek, Centenary Junior College, Hackettstown, N. J.
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